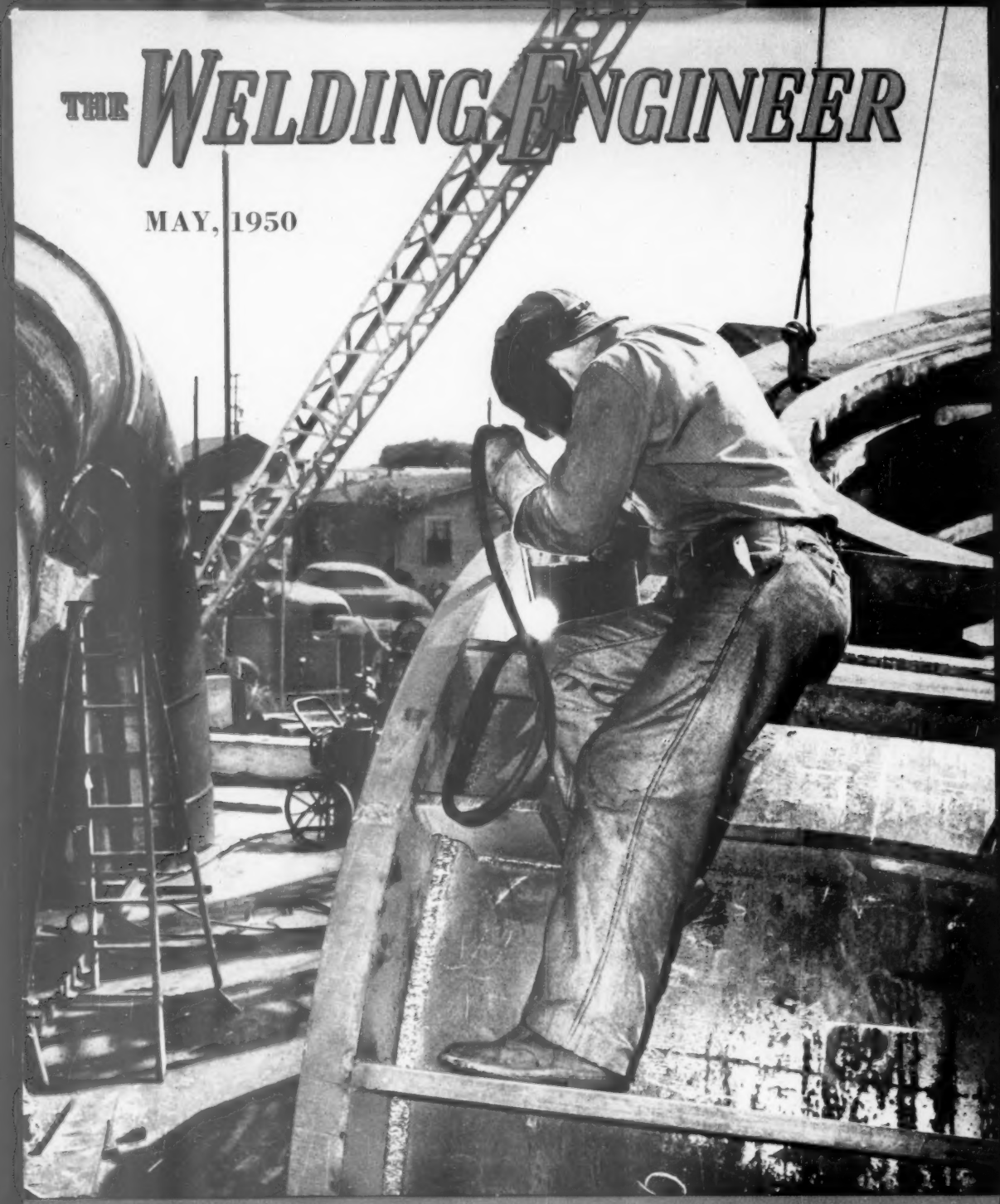
THE WELDING ENGINEER

MAY, 1950



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A McGRAW-HILL PUBLICATION

Tough Extra Flexible Easy to Use

Belden tough, extra-flexible Welding Cable is manufactured by wiremakers who have over 40 years' experience in production technique and research. The Belden Welding Cable conductor is made especially flexible with strandings of electrolytically pure copper wires. It has a tough, extruded rubber insulation. It is resistant to shock, kinking, heat, cold, or abrasion. Easy to use. When you order, specify Belden.

ask for

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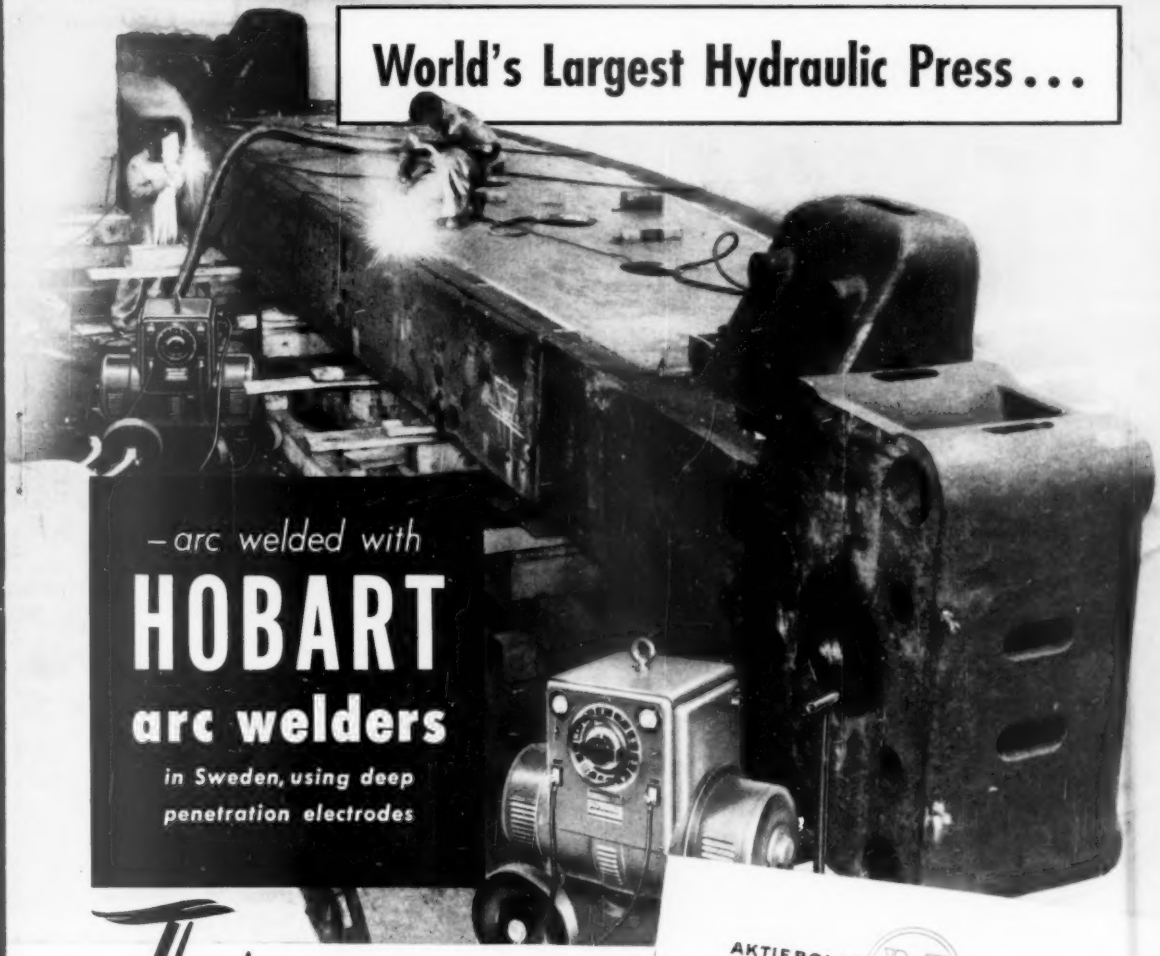
Welding CABLE

World's Largest Hydraulic Press . . .



— arc welded with

HOBART

arc welders

in Sweden, using deep penetration electrodes

Thanks — Mr. Per V. Norlin

for bringing this to our attention!

Hobart Arc Welders have long been the standard of the industry for the more important welding jobs, and we're happy to add the "World's Largest Hydraulic Press" to Hobart's long list of welding accomplishments.

For complete information, write **HOBART BROTHERS COMPANY, BOX U-50, TROY, OHIO**

HOBART

"One of the world's largest builders of ***arc welders***"

SEE OUR EXHIBIT
HOUSTON INDUSTRIAL EXPOSITION, MAY 10-14, 1950

AKTIEBOLAGET MOTALA VERKSTAD

Messrs. Hobart Brothers Company
Box U-120
T r o y
U.S.A. /Ohio

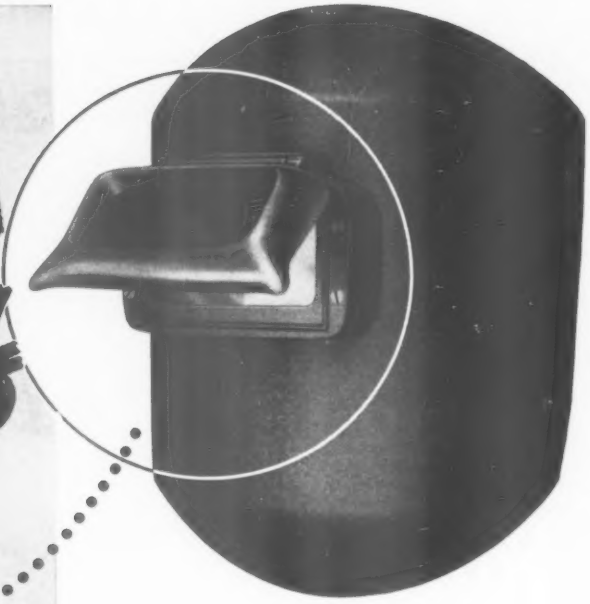
Gentlemen: Sept. 20th, 1949.

In 1947 we bought three Hobart Welding Machines for welding of copper with the carbon arc, and particularly for welding with bi-coated deep penetration electrodes.

The machines are in daily operation and function rough unless certain faults are occasionally made to appear, as the fault in question of the machine is then welded at current at right and the fair characteristics of the machine is then welded at current at right and the fair characteristics of welding a high welding current at right and the fair characteristics of welding a high welding current at right and the fair characteristics of welding a high welding

EXTRA STRONG

where it takes abuse



CESCO's 545-W welders goggle is tops in safety, comfort and durability. Perfected shaping of cups plus Comfort-King headband reduce tension on face.

PROTECT YOUR FILTER PLATES with CESCO's new plastic cover lens. Outlasts glass 100 to 1. For better visibility use CESCOWELD filter plates and lenses.

CESCO'S IMPROVED LIFT-FRONT TYPE WELDING HELMET features a new, stronger-built, moulded plastic lens holder. This new lens holder, reinforced to give it the strength of metal, is impervious to heat or flame . . . a non-conductor of electricity. Streamlined to prevent slag accumulation, it has exclusive shock absorber plus soft spring action to relieve snap or jar when door is raised and lowered. The one-piece seamless shell is drawn from hard vulcanized fibre, and has adjustable chin rest and adjustable headgear with leather sweatband.

Write for catalog showing CESCO's *complete line of welding helmets* and *goggles.*

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THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

A McGRAW-HILL PUBLICATION

Volume 35 Number 5

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THE WELDING ENGINEER is indexed regularly by Engineering Index, Inc.

MAY, 1950

COVER: Welding discharge flange on one of "world's largest" pumps, for installation at Grand Coulee. Flange is of 3½-in. firebox plate. See page 22.

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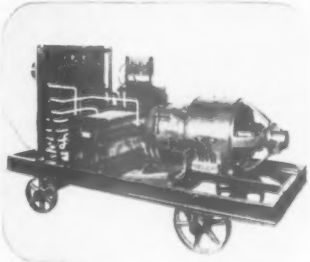
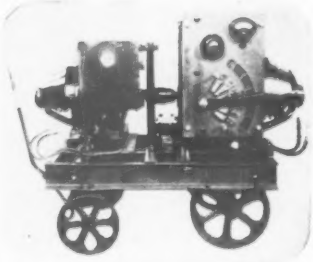
1950 models

40 Years of G-E Arc-welder Development Have Constantly Raised Performance Standards . . . STEADILY LOWERED PRICES!

All prices and data are based on standard 300-amp d-c welder, complete with mounting base, but *excluding* running gear.

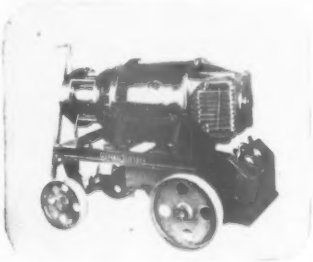


1911—This early d-c welder weighed close to 3400 pounds assembled. Individual components were priced separately.

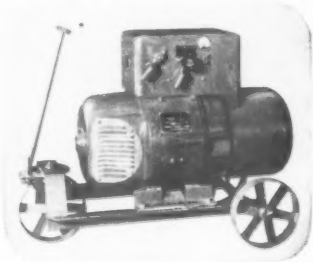


1918—This motor-generater welding set tipped the scales at 3185 lbs. Complete set was priced at $1220.

1927—Weight was down to an even ton by now, but equipment was still comparatively large and unwieldy. Price—$850.

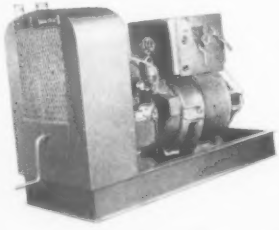


1930—Much more compact, but still weighed 1665 lbs. Price—$730.



1934—Weighing 1435 lbs., this model sold for $660.

ENGINE-DRIVEN WELDERS, TOO . . .

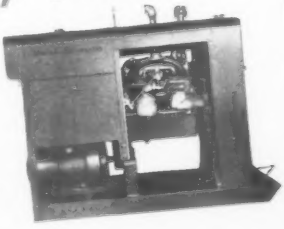


← IN 1939

This liquid-cooled (Hercules) engine-driven 200-amp d-c welder sold for $740, weighed 1220 lbs.

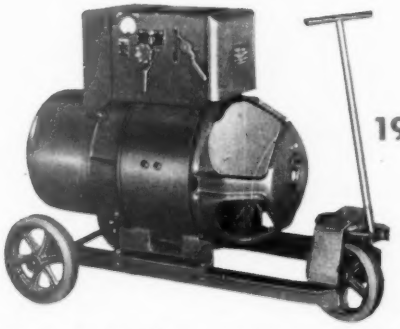
TODAY →

This 1950 200-amp welder, again with Hercules engine-drive, is 300 lbs. lighter for increased portability . . . gives superior welding performance . . . price—$725*.



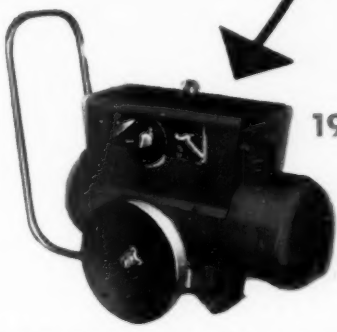
at 1940 prices

Today's G-E WELDERS give you 5 major improvements—for less money



1940

1940—This standard 300-amp d-c welder weighed 1310 lbs., *priced at $435,* exclusive of running gear.



1950

1950—This latest Type WD-43 300-amp d-c welder weighs just 650 lbs., *price*—$425* (exclusive of running gear).

1950 G-E welders give you many points of superiority, including these five major advantages:

1. Superior overall welding performance; hard-working arc is exceptionally stable, easily controlled.
2. General Electric's exclusive single-dial dual control for precise current control combined with complete flexibility and ease of operation.
3. 50% savings in size and weight; functional design has eliminated excess "dead-weight" with no sacrifice in quality or performance.
4. Easy, inexpensive maintenance; all you need is screwdriver and pliers.
5. Steady, dependable service over a long "life span."

Yes, General Electric welder design, performance, appearance have been continuously improved during the past ten years. With all these improvements for less money than pre-war, you just can't lose with a 1950 General Electric welder. Consult your nearest G-E Welding Distributor to determine the type and rating of welder best suited to your requirements; he can give you immediate delivery on all standard models. If you don't know him, write us for his name and address: **Apparatus Department, General Electric Company, Schenectady 5, New York.**

*Prices are manufacturer's suggested retail prices.

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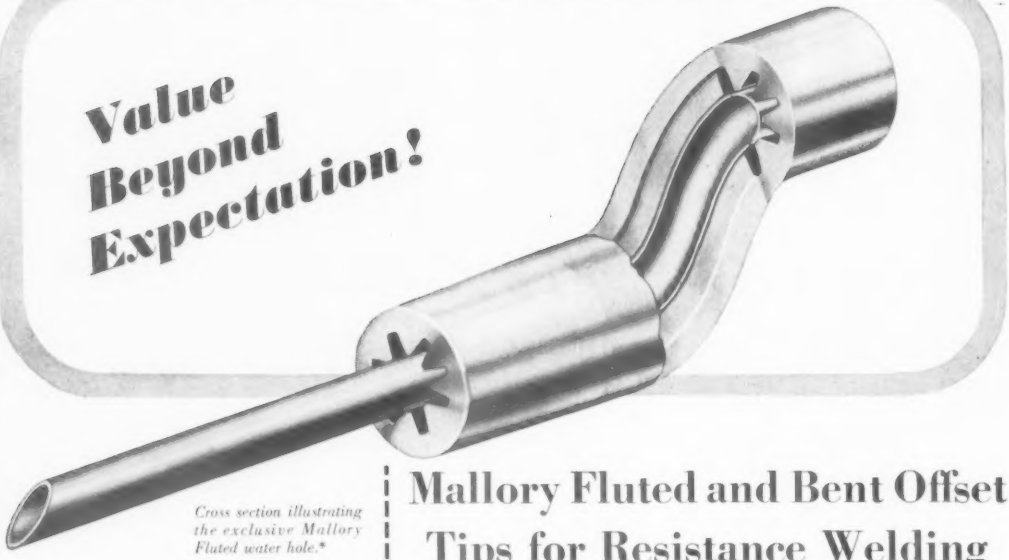

*Cross section illustrating the exclusive Mallory Fluted water hole.**

Mallory Fluted and Bent Offset Tips for Resistance Welding

Set New Standards for High Production and Low Cost

Making news in the welding field is an old story at Mallory . . . where new and practical ideas are the result of extensive research in resistance welding alloys, tips, holders and dies.

Mallory cold bent offset tips with the cooling tube bent in place bring the cooling water directly to the welding area. This exclusive Mallory feature has established new records in offset tip life.

Mallory fluted tips give 70% more cooling area. These cooler-operating Mallory fluted tips are establishing new low cost-per-weld records in every application.

Now you can have the ultimate in your welders . . . a combination of fluted water holes in bent offset tips . . . and you can have them through Mallory and Mallory alone. They bring you startling new production records at no increase in cost.

That's value beyond expectation!

Mallory's resistance welding know-how is at your disposal. What Mallory has done for others can be done for you!

West Coast Office and Warehouse: 1338 So. Lorena St., Los Angeles 23, California

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

REASONS WHY MALLORY FLUTED TIPS ARE SETTING WELDING RECORDS

- 70% increase in cooling area.
- Faster heat dissipation.
- Reduced mushrooming.
- Less frequent dressing.
- More rigidity.

Available in all types of tips with #1, #2, and #3 Morse tapers.

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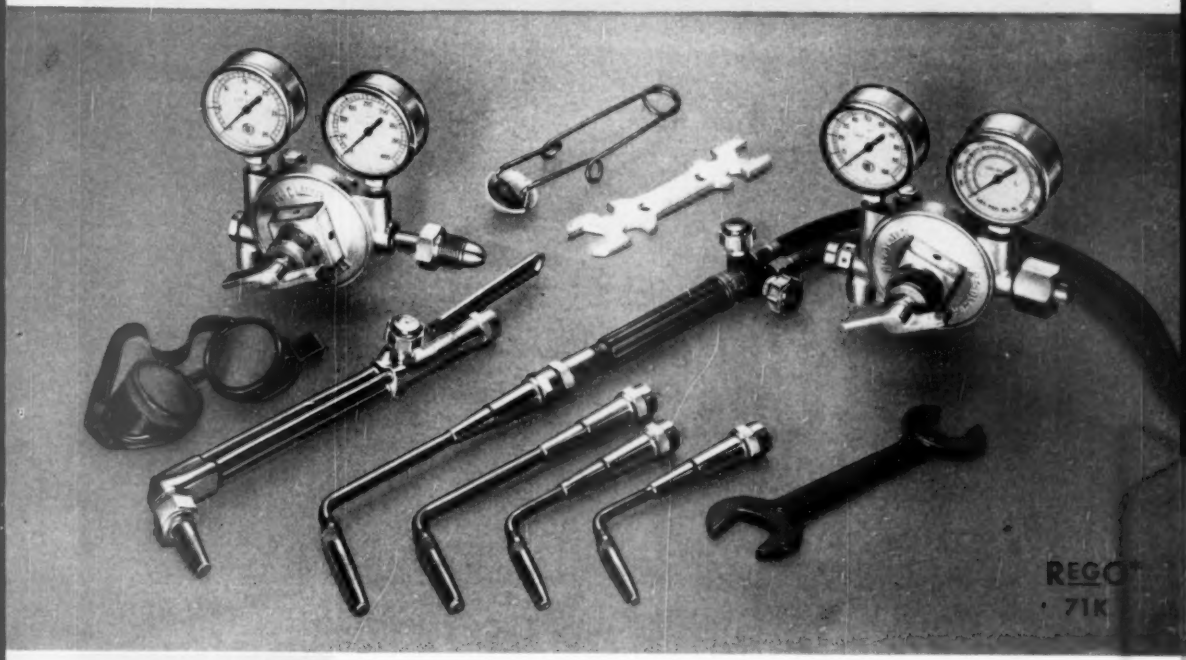

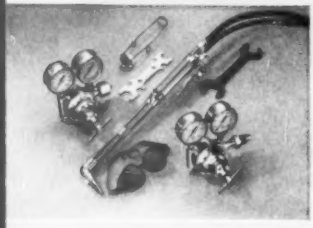

REGO 77 FOR LIGHT WELDING

An economical outfit ideal for sheet metal work, general welding of light gauge metals, and production welding of small parts. Will weld from 18-ga. to ¼-in. with tips furnished, from 28-ga. to 9/16 in. with other tips available.

REGO 57K FOR FAST HEAVY-DUTY CUTTING

An ideal outfit for contractors, scrap yards, mines, railroads, mills or wherever heavy work and rough use is encountered. Will cut up to 2-in. with tip furnished, up to 16-in. with other tips available.

. . . A SINGLE HEAVY-DUTY OUTFIT FOR *Both* WELDING *AND* CUTTING!

If you want on-the-job versatility, there's no outfit to compare with the REGO 71K. This is a heavy-duty combination that will do continuous welding—and when you want to cut . . . presto, simply detach the tip assembly from the welding torch handle and screw on the sturdy cutting attachment.

With tips furnished, the 71K Outfit will weld from 16-gauge to ¾-inch thicknesses, and will cut up to 1½-inches. Additional tips available increase the welding range from 28-gauge to the heaviest sections, and the cutting range up to 6 inches. The KXA cutting attachment is supplied with a 75° head or 90° head as specified.

But the 71K is only one of many sturdy, efficient REGO Outfits to meet every welding and cutting need. Illustrated and described at left are two others, one for heavy-duty cutting, another for light welding. Send for catalog containing complete information on the wide variety of REGO welding and cutting apparatus ready to save you money and time.

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Heavy-Duty Welding and Cutting Outfit Consists of:

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- 1 KX Tip No. 53
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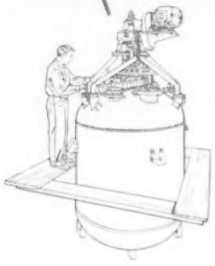
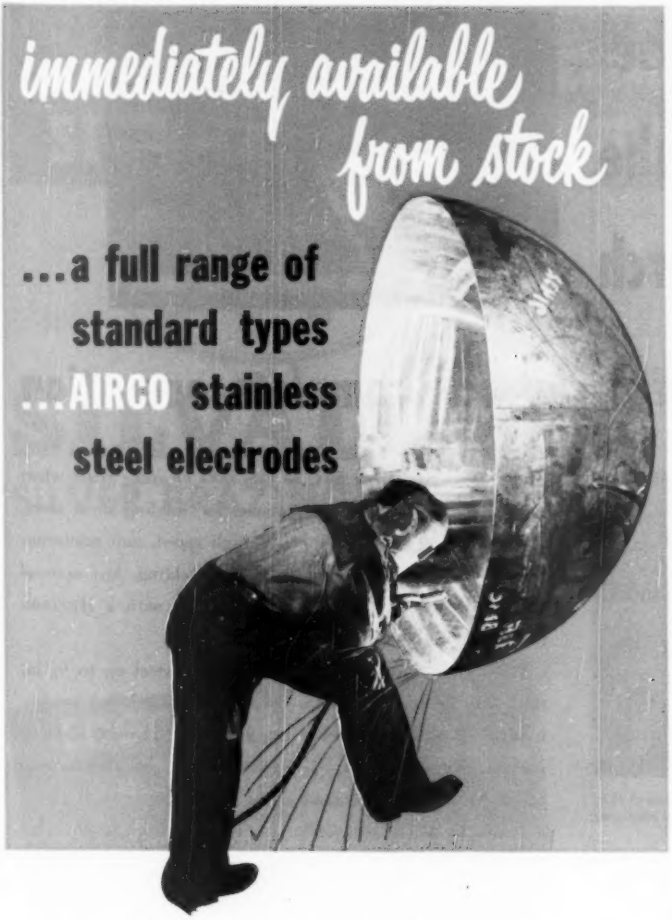


Murex Type FHP Electrodes play an important role in maintaining the high standards of welding set by The Pfaudler Co., manufacturers of glass lined and alloy processing equipment. This outstanding downhand electrode deposits weld metal of superior quality, and, at the same time is fast and easy to use.

Leading fabricators in many industries standardize on Murex — either to obtain better welding, or to achieve more economical production. Investigate Murex performance. Write for descriptive literature.



All Airco Stainless Steel Electrodes are designed to afford extreme operational ease in all positions — vertical, overhead and horizontal. Their arc stability and deposition characteristics assure smooth, flat weld deposits. Furthermore, Airco's continuing research permits you to get special stainless steel electrodes tailored to fit any unusual requirements that might arise.

These electrodes are supplied with two types of flux coatings — the heavy extruded lime type, specifically designed for application with DC reversed polarity, and the extruded titania type for AC or DC application.

These electrodes produce a spray type arc of excellent stability. The covering which serves as a flux gives rapid wetting action and completely covers the deposit. Because of this good wetting action, it is possible to produce welds which taper into the base metal, thus eliminating abrupt changes of contour which would be conducive to slag adherence.

For more information about Airco Stainless Steel Electrodes, write your name and address on the margin below, and send it to your nearest Airco office, or authorized dealer for a copy of Catalog ADC-650B.

More news about AIRCO products

IMPROVED AIRCO NO. 78E MILD STEEL ELECTRODE

No. 78E is an improved high quality E6010 electrode. It has a very smooth spray type arc with little spatter. The deposit solidifies quickly producing very smooth horizontal fillets. It also operates exceedingly well on vertical up, vertical down and overhead welding. The mechanical properties and X-ray characteristics are excellent exceeding the requirements of the E6010 class.

This electrode is used extensively in the welding of fittings on fired or unfired pressure vessels, storage tanks, structural frames, bridges, pipe lines, and all classes of marine work where high ductility and tensile strength are essential.

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For more information, write your nearest Airco office today for a free copy of Heliwelding Catalog No. 9.

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AIRCO **AIR REDUCTION**

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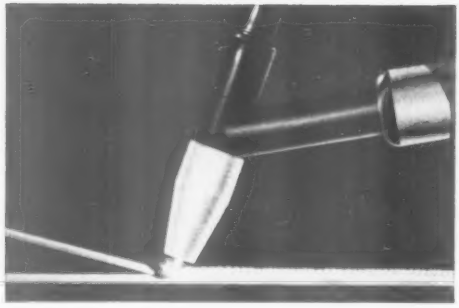
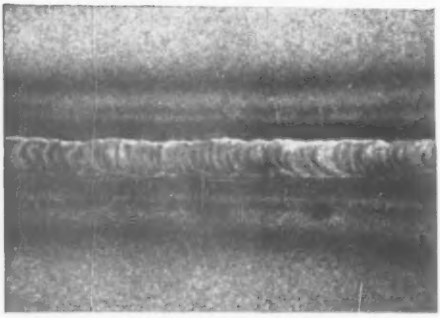
Weld Sheet Steel with the HELIARC torch

Trade-Mark



and wipe out one complete operation



AS WELDED — *This photograph, unretouched and natural size, shows that* HELIARC *welds in sheet steel are clean and uniform.*

There is no spatter or flux, so you save cleaning costs when you switch to the HELIARC process for welding sheet steel. And you keep the advantages of high speed, and minimum distortion that are characteristic of arc welding. Any manual arc or gas welding operator finds welding with a HELIARC torch easy to master.

Porosity-free welds in killed low-carbon steel up to $\frac{1}{8}$ in. thick can be made with this process. In non-killed grades, welds are as nearly gas free as can be produced by any welding process. Argon-shielding prevents pick-up of atmospheric gases. No argon is dissolved in the weld.

Joints welded with the HELIARC torch will not show under paint, lacquer, or even vitreous enamel finish. It takes only a light grinding to remove the low, smooth ripple and make the bead flush with the surface.

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THE LINDE AIR PRODUCTS COMPANY
30 East 42nd Street, New York 17, N. Y.
(or your nearest LINDE office)

Gentlemen: We would like more information on welding sheet steel with the HELIARC torch. We manufacture ..... (Product)
from ..... (Metal) of ..... (Thickness)
We are ☐ (are not ☐) now using inert gas-shielded welding

Name.....Position.....

Company.....

City.....State.....

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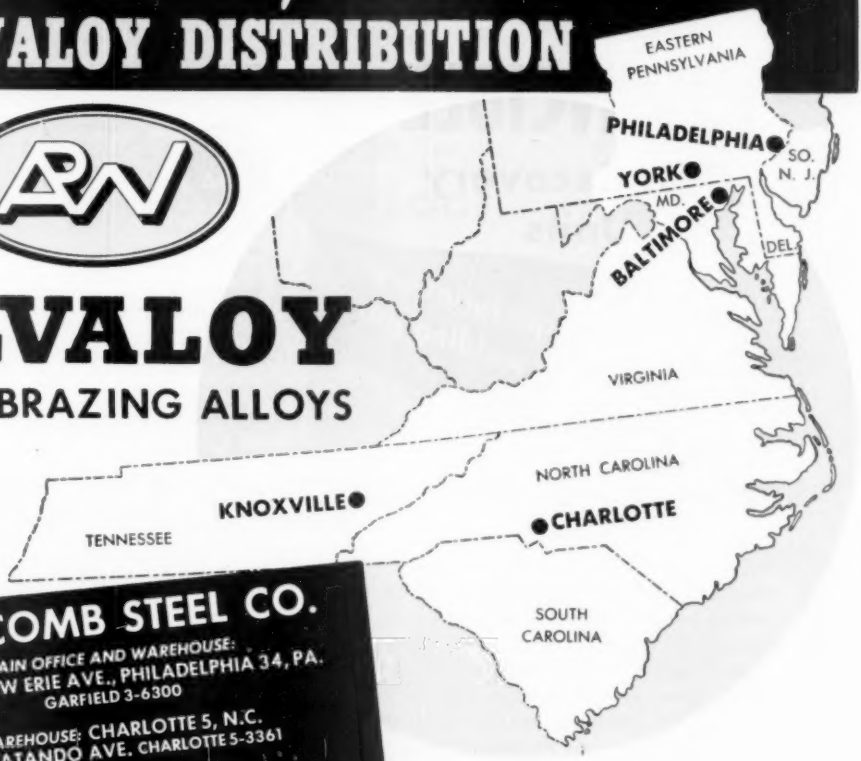

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YORK, PA., 101 E. MARKET ST., HAINES BLDG.
YORK 6181
KNOXVILLE, TENN., 201 EMPIRE BLDG.
KNOXVILLE 4-7014

	SILVER CONTENT	MELTING POINT	FLOW POINT
SILVALOY 15	15%	1185°F	1280°F
SILVALOY 20	20%	1430°F	1500°F
SILVALOY 35	35%	1125°F	1295°F
SILVALOY 40	40%	1135°F	1205°F
SILVALOY 45	45%	1125°F	1145°F
SILVALOY 50	50%	1160°F	1175°F

The Edgcomb Steel Company has taken over the distribution of SILVALOY Silver Brazing Alloys in the rapidly growing manufacturing areas shown on the map above. Their high standing and long experience in the metal field, plus their facilities for quick efficient service, guarantee you not only prompt shipment from stock, but also dependable co-operation in working out your silver brazing alloy problems from a technical standpoint.

The most widely used SILVALOY Silver Brazing Alloys are shown in the table at the left. For use with these alloys we recommend APW No. 1100 Low Temperature Flux or APW No. 1200 Universal Flux.

THE AMERICAN PLATINUM WORKS
231 NEW JERSEY R. R. AVENUE NEWARK 5, N. J.

INVINCIBLE
Flux Recovery Units

...the correct type for every submerged arc welding job

Hundreds of these Invincible units are saving money by efficiently salvaging unfused welding flux. They operate more rapidly and far better than any manual method. Also, by eliminating fine dust "flour" from the salvaged flux, they reduce welding rejects. Invincible Units are compact, easily installed and able to withstand continuous usage . . . To adapt this equipment to your needs, Invincible's unequalled experience in this specialized field is at your service.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

MODEL 482

An automatic, continuous flow system; ideal where entire unit is mounted overhead.

MODEL 490

A compact machine for use with portable submerged arc welding equipment.

FREE FOLDER ON FLUX RECOVERY

Describes and illustrates the complete Invincible line—*send for your copy Now!*

MODEL 480

An automatic, continuous flow system suitable where flux flour need not be removed.

MODEL 460

For portable use, or stationary mounting with wheels removed. Also serves as a vacuum cleaner.

NOW YOU CAN BUY . . .

NICKEL-ARC

— For Welding Cast Iron —

IN THE *New* MOISTURE-PROOF

ALL-STEEL CONTAINER

The numerous advantages of the all-steel container illustrated here have been proved since it was introduced a year ago by the Alloy Rods Company for packaging Arcaloy stainless and Tool-Arc electrodes. Now, by popular demand, this same container has been adopted for packaging the well-known NICKEL-ARC cast iron electrode.

- **EASY TO STOCK**
- **CONVENIENT 10# SIZE (5# for 3/32")**
- **MOISTURE-PROOF**
- **DIRT AND GREASE PROOF**
- **REPLACEABLE TOP**

NICKEL-ARC cast iron electrodes give you the smoothest arc with spatter-free action on A.C. or D.C. The soft machinable "as welded" deposits make Nickel-Arc electrodes ideal for repairing broken or worn castings.

If you weld cast iron, you can now get Nickel-Arc electrodes packaged in the new all-steel container from your Alloy Rods Distributor.

If you are a distributor and are interested in Nickel-Arc Electrodes, write us for our proposition.

Alloy Rods Co. YORK, PA.

ALLOY RODS CO.

5540 WEST MARKET STREET
YORK, PENNSYLVANIA

Look for the FLAMING-ARC trademark

How to Lick Arc Blow and other Problems too with the Lincoln A.C. Welder

By Duane Brady, Vice President
Welded Products Company
Grand Haven, Michigan

OUR production involves bases, brackets, tanks, sheet metal frames, small parts, heavy sections . . . an extremely wide variety of products. We have long and short welds, in-the-corner joints, plug welds, tack welds . . . the whole assortment.

Fabricating a base with the Lincoln 300 amp. "Fleetwelder".

To beat competition, we need all the welding speed we can get and top quality welds on all of our wide variety of work.

Up until recently, we've been using Lincoln "Shield-Arc" Welders just about 100% because these D. C. welders certainly are versatile. Their Dual Continuous Control gives us the right arc for every job.

Then we got into a base job with considerable arc blow. We needed to lick the arc blow so we could use high currents and get faster welding . . . so we investigated A. C. welders for this job. Having tried A. C. welding many times, we knew it was good for some jobs but not for others.

We were surprised to discover that the Lincoln A. C. "Fleetwelder" not only licked the arc blow problem but did a swell job on many types of our work. It's "Arc Booster" and fine setting Continuous Control have certainly made A. C. welding a versatile tool.

Now, having both D. C. and A. C. welders, we can use the right type to get greatest productivity on every job.

The "Arc Booster" of the A. C. "Fleetwelder" gives speedy welding even on short beads for sprockets like this.

On heavy material or sheets, the "Fleetwelder" can be accurately set for easy, high-speed welding.

GET THE FACTS

Write for "Fleetwelder" Bulletin 366

THE LINCOLN ELECTRIC COMPANY
Dept. 75, Cleveland 1, Ohio

Sales Offices and Field Service Shops in All Principal Cities

LINCOLN

THE WELDING ENGINEER

ESTABLISHED 1916 MAY, 1950

Are We Poisoning Invention?

On March 7, 1950, the United States Patent Office issued patent No. 2,500,000 to Francis M. Lambert, a gentleman of Narberth, Pa. It was for a quick-acting mechanism to latch doors, particularly applicable to the watertight doors of ships. Almost 160 years ago—on July 31, 1790—President Washington assigned patent No. 1 to Samuel Hopkins of Vermont. Hopkins got the first patent for a process to make potash.

It took us from 1790 to 1911—121 years—to issue the first million patents. Then inventors really got started. The next million patents needed only 24 years—patent No. 2,000,000 was granted in 1935. Yet only another half million patents have been granted in the 15 years between 1935 and 1950. Apparently, there has been a marked slowing down of ideas. Is there any reason for it?

We think there is. The patent has always been considered the truest symbol of the incentive system. It can also be considered as a sort of clinical thermometer to measure the health of the system—our system designed to encourage individual initiative and ingenuity. The patient's temperature is definitely falling. Can the cause be found in the present heavy taxation combined with a punitive outlook on the part of the Administration towards business?

It sounds reasonable to me. Who will strive to invent things if the fruits are to be taken away by the Collector of Internal Revenue? Why bother?

To put it in figures, patentable ideas are lagging approximately 25% for the years since 1935 as compared with the 24 years previous. In Britain, the patents granted between 1930 and 1946 declined 40%. Doesn't our declining inventiveness indicate that we in the United States are approaching a technological stagnation similar to that of England?

The trend in patents when coupled with the recently passed National Science Foundation bill will undoubtedly produce amazing results. It might be laughable—if it weren't for the disastrous effects to progress—to watch a government bureau trying to pick scientists and inventors to explore new frontiers. Think of the general overall planning this bill requires! Who among present officials resident in Washington will be able to pick the Edisons and Ketterings of 1975?

Certainly, no government bureau at the beginning of the twentieth century would have picked Henry Ford (the power plant helper) to pioneer the production of low-priced automobiles. Ford's own friends and neighbors called him a scatter-brained tinker. But the soil was then fertile for the growth of Fords. Today, the soil is being made sterile.

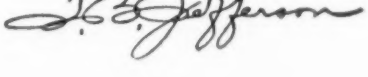
The economic progress of the United States is directly due to conditions that have provided maximum opportunities for reward. Period. There is, of course, some personal insecurity (was the cave dweller or tree climber ever secure?), especially for those who won't work. We don't deny it. But in lands where Karl Marx is God, "security" is given at the expense of freedom, initiative is encouraged by the concentration camp and the firing squad.

To everybody but a few people in Washington, it seems obvious that you can't delegate people to have inspirations. Creative ideas spring from within. All the bills that Congress can pass, working the clock around in joint session, won't call one genuine idea into being. Genius does not work according to fixed rules. It keeps no union hours, and it often turns up in the most unlikely quarters.

Inventive and scientific talent can't be produced by bureaucratic fiat. The creative mind eludes any formalized procedure for discovering it. It is developed only through natural selection, and it must discover itself.

The creative mind flourishes in an atmosphere where people are allowed to think clearly and freely. It is poisoned by a climate that stifles incentive and prevents a man from acting on his own.

Wonder how long it will be before we reach patent No. 3,000,000?



Plain Facts About

MANGANESE ELECTRODES

Here's another instance where you can't eat your cake and have it too!

If you demand the ultimate in sound, high-strength manganese weld deposits with no cracking or checking . . . you can get it with BARE STOODY MANGANESE electrodes. If you are willing to sacrifice high "physicals" produced by these bare rods for the sake of somewhat easier application . . . coated rods may do the job.

After a little experience, welders will find the NEW STOODY MANGANESE bare electrodes almost as easy to handle as many of the current coated rods. They will notice immediately how smoothly it lays down and its freedom from any tendency to crack. *Here is a manganese that is REALLY DIFFERENT—and better!*

In as-welded deposits, Bare Stoody Manganese produces these unusually high physical properties. We believe there are none better:

Ultimate Tensile Strength—85,000 psi; Yield Point—61,000 psi; Elongation in 2"—18%; Reduction of Area—18%; Hardness (as deposited)—165-175 Brinell or 85-90 Rockwell B; Hardness (work hardened)—375-425 Brinell or 45-50 Rockwell C.

While we supply coated manganese, we earnestly suggest a thorough test of Bare Stoody electrodes . . . *for greater toughness . . . higher impact strength . . . full Hadfield properties . . . fast burn-off . . . low penetration . . . unusually good arc characteristics.*

For your next job order bare manganese from your Stoody dealer. Compare this rod with anything you've seen before. We're glad to leave the future choice in your hands. Literature is available.

STOODY COMPANY

11941 East Slauson Avenue • Whittier, California

NWSA

National Welding Supply Association holds sixth annual convention in Chicago, May 8, 9 and 10. Several lively sessions are promised

BY CLYDE B. CLASON

IF YOU are interested in the distribution of welding equipment—or interested in those who *are* interested in the distribution of it—plan to be in Chicago from May 8 through May 10. The sixth annual convention of the National Welding Supply Association will be held on those dates at the Hotel LaSalle in the Loop.

If you are an officer or director of the association, you will want to attend the preconvention dinner meeting of the board of directors, to be held on Sunday, May 7, at 6:30 p.m., in Parlor D on the hotel's mezzanine floor.

Registration begins as early as Sunday afternoon, 5 to 9 p.m. If you are a Monday morning arrival, however, you should register between 9:00 and 10:00 a.m. Simply take the elevator to the 19th floor. The first of three general meetings begins promptly at 10:00 a.m. in the Century room—same floor as the registration desk. After this meeting, go down to the mezzanine floor for luncheon in the Illinois room.

CONTACT BOOTH PROGRAM

Monday afternoon you will want to hold open to go "contact booth-ing." This is a new idea for conventions: intended to take the place of both the customary exhibition and the convival gatherings in hotel rooms. Each occupant of a booth—welding manufacturer or distributor—is given a space in which to receive and entertain his visitors. Since all the booths will be located in one big room—the hotel's grand ballroom—it will be comparatively easy for a convention delegate to make the rounds and talk to everyone he wants to see. This novel plan cuts out the expensive and elaborate formal exhibits.

The contact booth program will be held on both Monday and Tuesday afternoons, beginning at 2:30 p.m., in the grand ballroom on the 19th floor. Take advantage of it!

MONDAY'S PROGRAM

The Monday general meeting will be featured by the annual address of NWSA President Robert S. Mars (of W. P. & R. S. Mars Co., Duluth, Minn.) and by talks by Arch Morris, publisher of THE WELDING ENGINEER, and R. P. Melius, vice-president in charge of sales, power tools division of the Rockwell Mfg. Co., Milwaukee. Mr. Melius will speak on "Sales and Selling."

Mr. Morris, whose subject is "Distribution—a Square Peg in a Round Hole," has just completed his 30th year in the publishing business. His publishing experience started with The Engineering Magazine Co., publisher of *Industrial Management* (now *Factory Management and Maintenance*), later purchased by the McGraw-Hill Publishing Co., Inc. For two years Mr. Morris was with *American Magazine*, and then he went back to McGraw-Hill as general manager of *Mill Supplies*—now known as *Industrial Distribution*. He is today publisher of this magazine and also publisher of THE WELDING ENGINEER, both McGraw-Hill publications.

For the past 22 years, Mr. Morris has been closely associated with distributors of industrial equipment, tools and supplies. He is the author of a marketing guide, "Industrial Distribution and Marketing," that was published originally in 1940 and reissued in 1945.

TUESDAY AND WEDNESDAY

On the Tuesday morning session are C. I. MacGuffie, manager of sales, welding division, General Electric Co., Fitchburg, Mass., and George W. Cloos, economist, Federal Reserve Bank of Chicago. Mr. MacGuffie has chosen as his subject, "A Manufacturer Looks at Welding Supply Organizations," and Mr. Cloos will discuss current business conditions and the outlook for the remainder of the year. There will be a luncheon after this meeting in the Illinois room on the mezzanine floor.

A. M. MORRIS, publisher of *Industrial Distribution* and *The Welding Engineer*, will talk on the subject, "Distribution—a Square Peg in a Round Hole." Mr. Morris has been closely associated with distributors of industrial equipment and supplies during the past 22 years

Guest speaker at the annual banquet will be Dr. Harlan Tarbell, who will conduct a presentation entitled "Eyeless Vision." You won't want to miss this affair, which is slated for the Illinois room at 6:30 p.m.

Wednesday's general meeting will also be held in the Illinois room, beginning at 10:00 a.m. The program will consist of discussions of industry problems, as they are brought up by distributor and manufacturer members of the association. No group luncheon is scheduled for Wednesday, though many members will doubtless meet informally with their friends.

To sum it all up, it looks like a very interesting three days. Plan to be in Chicago on May 8, 9 and 10!

WINDOW OF Tucson store of Arizona Welding Equipment Co. Plenty of merchandise where it can be seen!

SHOW ROOM at Phoenix. Customers must pass display of heavier equipment before they reach counter area

Show 'Em

BY T. B. JEFFERSON

POINT ONE: Obtain an adequate building. Storage and docking facilities are important. So are parking places if you want customers to come to the store. They won't beat a path to your door on foot.

POINT TWO: Proper display. One of the first rules of successful merchandising is to get the merchandise out where customers can see it. Ask Woolworth or Kresge. Hal Savage has plenty of counter space and display cases. He hangs other items on the wall and marks all of his prices plainly.

POINT THREE: Trucks. Take the merchandise out to your customers when they don't come to see you. Savage fitted his trucks with special cabinets to carry small supplies and tools. His drivers are salesmen, and he pays them on a salary-plus-commission basis.

COMBINE the words "Arizona" and "welding," add the all-important "equipment," and we have Arizona Welding Equipment Co. (or AWECO), one of the busiest and most aggressive organizations of any kind in Phoenix.

Arizona Welding Equipment Co., came into being on a shoestring. Nine years ago, on March 19, 1941, Hal Savage came to Phoenix from California to launch a new company with $1,500 in borrowed capital, a stock on consignment and a one-armed helper. George White, the one-armed helper, did the work of two men in repair jobs, accounting, waiting on customers, shipping, receiving and whatever else was necessary in the office. Savage put his time on the road selling. His territory, he considered, was nothing less than the entire state of Arizona.

A Long Way between Drinks

Since it's a long way between drinks in Arizona, Savage often found it difficult to make profitable sales solicitations. Much of the state is desert, and gila monsters buy little welding equipment. As a salesman, Savage had often to travel as much as two hundred miles to make a single call. To make such calls pan out, other lines than welding had to be added from time to time. From the very beginning, however, Arizona Welding Equipment Co. has been and (according to present thinking) always will be a basic welding supply business.

No one could safely predict just what was going to happen to Arizona industrialwise at the close of the war. There were strong forces at work to restrict the growth of industry within the state, much feeling that industry might jeopardize the huge income Arizona derives from her winter visitors and health seekers. The dude rancher guests who came there in quest of quiet and fresh air might object to seeing a smoke-laden sky. Let Arizona remain as she was, a great outdoor playground. . . . "All very well," objected the other side, "but what we really need is jobs for the great number of people who are becoming permanent citizens of our state."

With this thought in mind, the Chamber of Commerce began to advertise the possibilities of manufacture in a mild climate. Groups of private citizens devoted time and money to coax manufacturers to come to Arizona and take advantage of a good labor market. Among other farsighted local concerns, Arizona Welding began to prepare to meet the coming new industries.

COUNTER AREA at Phoenix runs from front to rear of the building. Customers may enter from either end

WALL DISPLAYS back up the counter and showcases. Prices of all the items displayed are marked plainly

to Sell 'Em

During the reconversion period after the war, the company had to raise additional capital to take advantage of the many lines offered. It was necessary to reorganize. This was accomplished by incorporating the business in 1945. Hal Savage became president. The stock of the company was offered only to local employees and to a selected group outside.

His Sixfold Program

Savage looked over the history of our country after the first World War. It seemed fairly certain to him that a similar economic pattern would follow after World War II: two or three years of boom times, then a slight "recession" if not depression. The company, he decided, had to take advantage of the boom to reach certain goals within the three years immediately after peace. His sixfold objective was:

1. To obtain an adequate building, one with proper display, storage and docking facilities.

2. To establish trucking routes throughout southern Arizona.

3. To enlarge the territory in which oxygen and acetylene are distributed. This meant buying out a reseller in Tucson, adding his facilities to the Tucson branch.

4. To weed out poor lines and solicit the distributorship of the finest lines of welding equipment, light machine tools, industrial supplies and power transmission equipment.

5. To complete the transition period with a well balanced inventory.

6. To develop a long-range financing program. It would have to put the company in the best possible position to accomplish its current aims and to move quickly in the future when the opportunity came to take on other lines and perhaps more diversified merchandise.

During the postwar years, AWECO has been able to accomplish all of these aims. *First, the building.* There were several false starts; several sets of plans were drawn only to be scrapped because of the rapidly increasing building costs. After Savage had listened to many fruitless propositions by realtors, he finally had a piece of good luck. A steel company built and leased to AWECO a steel building in the heart of the Phoenix industrial area; AWECO had only to design and install the interior fittings. The company is now located in a perfectly suited building and has a long-term lease. Money outlay was kept to the minimum. An option arrangement allows AWECO to buy the building in the distant future.

The Tucson enlargement: AWECO acquired the business of the Tucson reseller in 1945. A Tucson branch came into being with a substantial stock of merchandise, an office manager and a salesman. The Tucson branch operated originally almost as a separate company. It soon became apparent, however, that money and effort could be saved by consolidating the purchasing and general office functions in Phoenix. Tucson became primarily a sales office.

Contact between Tucson and Phoenix is maintained by means of a teletype. The Tucson sales supervisor has the authority to buy direct from manufacturers on non-stock items. The scarcity of good industrial outlets in Tucson causes this branch to process many more non-stock purchase orders than the Phoenix store.

Where They Can See It

One of the first rules of good merchandising is get the merchandise out where people can see it. Ask Woolworth and Kresge. Savage studied the store plans of other welding distributors and of automotive and industrial supply houses. It was obvious that those who were forging ahead had given considerable thought to display. "The more you show, the more you sell," concluded Savage. Here is how he planned his building layout:

The counter area runs from front to rear of the building. Customers may enter from either end. Those who come in the front door pass through the show room where heavier equipment is displayed. When they reach the counter area, they are hit by displays of small merchandise on both walls. These displays are attractively arranged and indirectly

lighted. The efforts and ideas of all personnel go into planning them.

Some customers park their cars or trucks and enter the building from the rear. These visitors pass the bin and shelves in the warehouse proper. Old display cabinets, lined up to form an aisle through the warehouse, keep the customer from entering the storage area. These older display cases are utilized to show odds and ends that may be bought at bargains. During his walk, the rear-door customer also has an opportunity to view merchandise neatly arranged on steel shelves and bins. And as a final clincher, he is led past a demonstration area where arc welders and oxyacetylene apparatus are waiting ready for immediate use.

Coming up to the counter, the customer finds that all merchandise is on display and price marked. While he waits to be served, he can answer many of his own questions about what the company handles and how much. Actual articles offer visual suggestions of his possible needs. Obviously, it would be impossible for the counter salesman to mention the thousands of items stocked, but the customer can see them.

Men Who Do the Selling

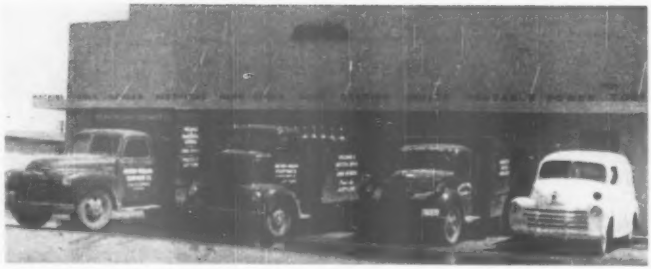
A sales business can be no better than the people who do the selling. The Phoenix store employs two full-time counter salesmen; the Tucson store has one (plus the assistance of the office manager and shipping clerk). These men are carefully picked for sales ability, tact and courtesy. Counter salesmen are not merely clerks or order-fillers.

AWECO knows that the best place to meet and sell a customer is in the store. Each customer is carefully served. If he shows even casual interest in a displayed item, the counter salesman gives him full information and tries to close on the spot.

In emergencies, every person in the store from the president on down will be called upon to take a turn at the counter; other work can wait, but the customer can't.

Counter salesmen are on a salary-plus-commission deal. Their counter commission is in the form of a pool or "kitty," which is split up monthly.

The Phoenix store employs a full-time man at the order desk. He sits at the 'phone all day long, taking orders and following them through. This employee is carefully chosen. Selling on the 'phone is an art. It can't be done unless you have full knowledge of all the products you handle. A man who has served on the order desk is a very good candidate for an outside selling job.



TRUCK FLEET before the new Phoenix sales building. Besides oxygen and acetylene, the trucks also carry electrodes, welding rods and small tools

Drivers Sell, Too

Goal No. 2 in the company's program was trucking routes. AWECO operates five truck routes—three from the Phoenix store, two from Tucson—to serve the area covered by the company's oxygen-acetylene franchise. Each truck is fitted with special cabinets to carry supplies and small tools.

These trucks are operated by truck-salesmen, not by mere truck drivers. Naturally, these men are not required to have as complete knowledge of the products handled as the regular salesmen. They are, however, selected on the basis of sales ability, a friendly attitude and ambition as well as a strong back. Truck sales work is the hardest physical labor within the company, but it pays off well to the energetic driver-salesman. AWECO's truck-salesmen have definitely established routes and customers who are, for the most part, absolutely loyal to them.

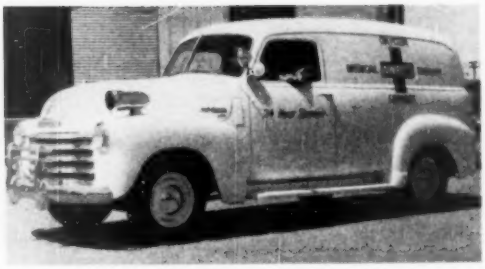
The highest compliment that can be paid to the truck-salesman is for a customer to make him "purchasing agent." Let's look at that for a minute. Many of the routes cover isolated communities where customers will order every possible item from the AWECO man. It's not uncommon for the truck salesman to spend his Saturday off in making purchases for his route customers—at a profit to AWECO, of course. Like other salesmen, the truck-salesman is on salary and commission. The more welding gases and merchandise he sells from the truck, the more he earns.

Commissions are paid according to the classification of merchandise. There are three divisions: high, medium and low margins. Each class of item carries a different commission rate. The system has a natural tendency to channel sales effort into the items on which the company makes the most profits. A salesman won't put in too much of his valuable time in selling low-margin items.

Outside salesmen are given credit only for those orders they actually write or which are 'phoned or mailed in. The counter salesman gets the credit (and commission) when the customer walks into the store. There were those who said such a system wouldn't work because outside men would be disgruntled when their customers came to the store. Despite some arguments, however, the system had the desired effect. The outside salesman works harder to close the sale on the spot; the customer has less opportunity to buy the item from a competitor; the counter salesman exerts more effort to sell during their golden opportunity when the customer is in the store. Furthermore, instead of hard feelings there is a fine spirit of teamwork between the counter and outside men. The counter men, knowing that they are being materially helped by the outside men, try to pay the debt by turning over to the outside men all the tips they receive. The outside man is notified of any interest aroused in the store so that he can follow up, close the sale and receive commission credit.

AWECO divides the indirect office expense among the sales force when

COMPANY TRUCK with its driver-salesmen. There are three truck routes from Phoenix and two from Tucson



OXYGEN THERAPY service is provided by a special truck stocked with medical oxygen and other supplies

it determines the net monthly profit that each salesman makes for the company. This is justified by the logic that the function of the office is only to back up the sales force. It is accomplished by predetermining by percentage the division of indirect expense among outside salesmen, counter sales and truck sales. Each salesman is given an equal percentage within his classification. Roughly, each outside man carries 11% of the indirect expenses, each counter man 7%, each truck salesman 4%. (The direct expense chargeable to truck salesmen is, of course, extremely high.) From the gross sales of each outside, counter and truck salesman, the accounting department subtracts first the cost of the merchandise sold, next the direct expenses and finally the pro rata share of the indirect expenses. The management can thus readily determine whether or not any man is pulling his weight. If a man is dragging the average down, he receives immediate assistance.

Each salesman is given full information on how he stands in the profit picture. The salesmen are glad to see the company's profits rise because their own earnings go up accordingly.

Repair and Service

AWECO houses a complete welding equipment repair shop in the Phoenix store. In each store, one man is designated as service man (in addition to his other duties). The service department is able to repair all makes of oxyacetylene welding equipment and make minor repairs on arc-welding equipment. For major work on arc welders, the company has a working agreement with a large electrical repair shop.

In addition to making repairs on equipment brought in directly, the company maintains working agreements with some of its competitors to handle their work. Customers are loaned apparatus at no charge to use while their own is being repaired. Several arc welders and complete oxyacetylene outfits are also maintained in rental service. These are used, for the most part, by regular customers who have larger-than-usual jobs or by construction companies coming into the state who do not wish to transport this type of equipment. Beside providing a very good source of income to AWECO, the rental service performs an invaluable and inexpensive service to customers.

The company's two service men are expert mechanics and troubleshooters. Both men joined the firm from eastern companies, coming out to Arizona for reasons of family health. They are indispensable in troubleshooting on maladjusted equipment of all kinds. There is usually no charge for their services unless actual repair work is involved. To lessen the expense of this service, the entire sales force is schooling itself in troubleshooting.

An AWECO salesman is far more than a glib talker. First, he is required to be able to demonstrate all welding processes and equipment sold by the firm. That's just the beginning. The idea is that he must be able to solve any welding problem brought to his attention and to give technical advice where it's needed. Where technical assistance is wanted, salesmen sometimes remain on the job for several days to help lick a problem. AWECO never charges for this service. The loss of salesmen's time often amounts to considerable expense to the company, but it pays off.

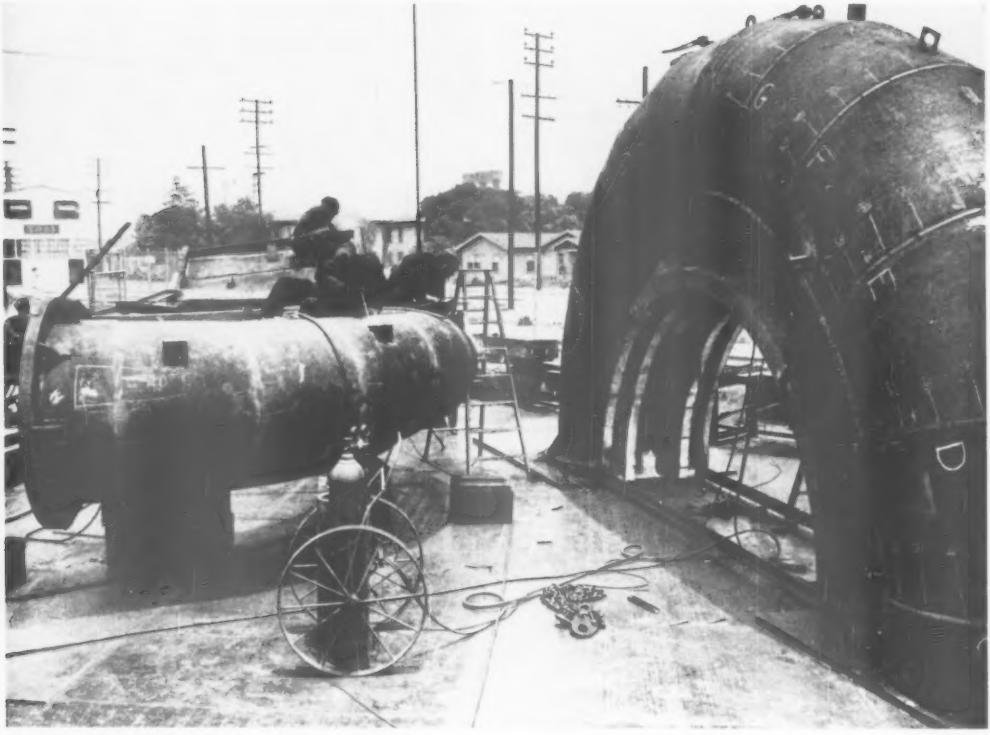
Oxygen Therapy

Recently, the firm has added to its list of services in the Phoenix area the AWECO Medical Oxygen Therapy Service. This is a specially equipped truck stocked with medical oxygen and all types of therapy equipment. It's operated by a trained technician and is available on 24-hour call. This type of service fits in extremely well with welding. There is a very wide sales field since so many people come out to Phoenix because of lung trouble.

The company's gross business is divided approximately 65% welding supplies and equipment, 35% non-welding or industrial supplies and equipment. Its customers may be split up as follows:

Mines, mills and smelters...15%
Construction and contractors 15%
Welding and machine shops 25%
Other industry and farming 25%
Wood-working trades 10%
All other 10%

Arizona is noted for its copper mines, yet AWECO has not made itself dependent on the mining industry in Arizona because of the federal government's policy on copper imports. The company is constantly enlarging upon its lines of "expendable supplies" so it will be able to maintain its volume of business in the event of a loss of the new equipment sales. It is axiomatic that a welding supply company, if properly managed, will do as well in poor times as in good times because more of its customers will turn to repair and maintenance of old equipment and that requires oxygen, acetylene, welding rods, electrodes, etc.



1—WELDORS ATTACH alignment pads to one-half of a pump shell for the Grand Coulee dam. The two halves you see in this picture will be bolted together at the site. Approximately 90 days of welding are required on a pump

World's Largest Pumps

Helpful hint: To end cracking in thick sections, try low-hydrogen electrodes. They avoid cracking by minimizing hydrogen pick-up in the welds. Of course it also helps to preheat the heavy sections

BY W. E. CHRISTISON
Plant Superintendent, Los Angeles, Pelton Water Wheel Co.

2—TURNBUCKLE clamps casing to casting for welding. Fittings by which this handy device is attached will afterwards be removed by flame-cutting

SIX king-size pumps, each to be driven by a 65,000-hp motor at 200 rpm, are now being manufactured for the Grand Coulee pumping plant of the Bureau of Reclamation. As nearly everyone knows, this vast power and irrigation project is located on the Columbia river, not too far away from Spokane, Wash. The six mammoth pumps will furnish some 850,000,000 gallons of water per day to irrigate and reclaim 11,000,000 acres of arid land. A worthy cause if there ever was one!

These big pumps are claimed to be the "world's largest." The hydraulic design was by Byron-Jackson Co., Los Angeles, and the mechanical design and manufacture is by

3—MANUAL HIDDEN-ARC welding (equipment visible in background) is used to weld casting sections 3 to 5 in. thick. Once a weld is started, it's continued until it's done. Sometimes one weld takes 24 hours to finish

for Grand Coulee Dam

The Pelton Water Wheel Co., of San Francisco and Los Angeles.* The pump casings and the suction tubes are being fabricated at Pelton's Los Angeles plant; the remainder of the work at Pelton's main shops in San Francisco.

Work in Steel up to 5 in.

The men who make these pumps have to weld steel up to 5 in. thick. That involves the handling of materials of large tonnage. The techniques and procedures developed have been successful and are of significance for this class of work.

Obstacle No. 1: Heavy castings or thick plate sections have a natural tendency to crack when they are welded. Add to that the requirements for X-ray quality welds, and you'll get an idea of the major welding problems involved in this job.

After experimenting with various types of electrodes, we reached a decision to use a lime-ferritic E-6016 type of electrode. This worked out very well, but we also had to give the big casting a slight preheat or warming to prevent cracking trouble.

More Metal per Pass

An advantage of the lime-ferritic type of electrode in a deep-groove weld is that you can use a vertical welding technique. This type of electrode carries a larger amount of weld metal per pass than is customary with E-6010. It makes possible a reduction in joint preparation and also facilitates the removal of slag. Add the savings in clean-up time to the greater cross-section of weld per pass, and you will see why and how you can cut the total overall welding time. As still another benefit, dense, ductile welds can be made in "hard-to-weld" materials.

In Fig. 1, the two halves of a pump casing are being fabricated. These colossal halves will be bolted together to form the entire pump shell or volute. You would think it would take a long time to weld such a pump, and you would be right. One pump requires approximately 90 days of welding on the castings and casings.

The sections of the casing are of steel plate varying in thickness from 13/16 in. to 1½ in. They are rolled to a template so that there is little difficulty in fitting them. When the sections are fitted into position on the shoulder casting, seams are faired

*See article "Preheat to 500 F," The Welding Engineer, March, 1950.

by means of dogs, wedges and turnbuckles.

A stringer weld is made to join the casing sections; then the welded plate casing is removed from the casting and turned over. The insides of all seams are flame-gouged for approximately three-fourths of the way through the entire plate. The section is placed on a large positoner while the inside seams are welded with E-6020 electrodes.

When the inside has been welded, the casing is again turned over. The outside stringer welds are flame-gouged to clean the weld, and the joints are finish welded on a positioner.

X-rays are taken of the casing weldments. If all of the seams pass this examination, the casing is put back onto the casting. Fig. 2 shows how it is done. A turnbuckle serves to pull the two together; this useful accessory will be removed after tack welding.

The flame-gouged seam is welded with two passes on the outside and one on the inside, using ¼-in. E-6016 low-hydrogen electrodes. Current setting is a minimum of 300 amp. Cracking between the 2-in. steel casting and the 1-in. steel plate of the casing is eliminated by this type of electrode through the minimizing of hydrogen pick-up in the weld. A preheat of 400 F is used.

The front cover of this issue of THE WELDING ENGINEER illustrates still another job for low-hydrogen electrodes on these pumps. A 3½-in. discharge flange of firebox plate is being welded to a section of 1⅜-in. plate. This tidy little task takes a 3/16-in. electrode and a current of 275 amp. The coating on E-6016 electrodes makes it possible to use unusually high amperage with them; results are a high current density, rapid deposition, deeper penetration.

MANUAL HIDDEN-ARC WELDING

To weld extra-heavy sections at Pelton, we use the flexible "manual hidden-arc" process. In Fig. 3, the equipment is just visible in the background. Hidden-arc welding is used to join sections of heavy castings together. Sections on the order of 3 to 5 in. thick call for a large amount of metal to be deposited.

The manual hidden-arc process uses a 5/64-in. wire at 400 amp, the wire is fed automatically through a granular flux deposited around the arc. The high heats and high current density permit rapid welding speeds.

Point of interest: Once one of these heavy welds is started, welding does not stop until the weld is completed. Twenty-four hours of continuous welding is not uncommon. When the weld finally *is* finished, it must be slow cooled for another eight hours. It sounds odd, but a heater is used to cool the weld.

Photos courtesy of The Lincoln Electric Co., Cleveland.

12 Self-Assignments to Sales Success—I

Richard C. Borden

This month begins a series of inspirational talks by a man who has achieved spectacular results in training men to do better selling

BY RICHARD C. BORDEN

As sales consultant for Westinghouse, the Borden Company and other large corporations, Dick Borden is known as one of the top sales consultants in the United States. His twelve articles, to be published one a month in THE WELDING ENGINEER, *are based on the script of a new Dartnell-Borden series of sales films called "Selling Against Resistance." Any salesman, welding or otherwise, can make good use of this material to accomplish greater volume and gain more satisfaction from his sales calls.*—THE EDITORS.

TO WIN top laurels in selling, it's not enough that you know what to do. You must also *do* what you *know*.

Resolve this year to ACT on that obvious truth.

Each month, make a determined effort to translate from theory into practice *one* of the twelve selling principles which follow.

Don't try to do everything about everything overnight.

Instead, tackle your self-assignments one at a time . . . giving each, in its turn, an intensive month's workout.

If you continue this systematic conversion of principle into practice, the end of the year will find you with increased selling skill of the kind that *sticks to your ribs* . . . of the kind that pays off, not just for today, but for all your selling tomorrows.

1. Light like a match

A good match lights with its first scratch.

A good salesman lights with his first sentence.

This month, in every presentation you make, resolve to kindle a quick flame of customer interest *with your first words*.

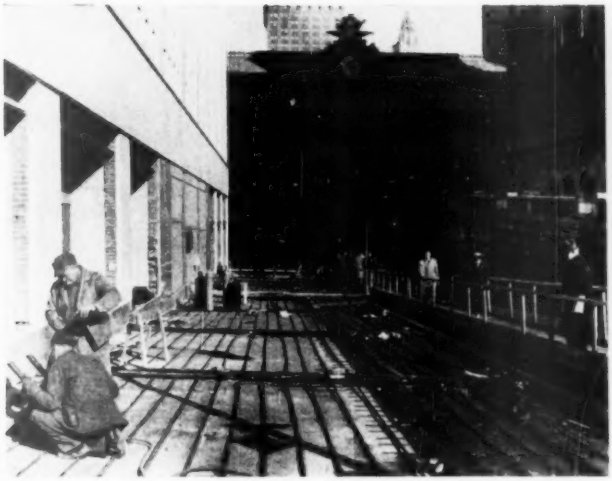
Aim to make those first words SELL YOUR SELLING INTERVIEW . . . so that from then on your customer will be listening to you with both ears, rather than with just a polite semblance of attention.

If you take this first self-assignment seriously, *not once* during the month will you begin a sales talk with this kind of soggy start:

"I dropped in on account of being in your neighborhood, figuring that maybe if you happened to have a little time to spare . . . why, uh . . . well, maybe you might be willing to spare me a little of your time to tell you a little about a little proposition that I got here."

This month, make sure none of your presentations start that way.

Make sure, instead, that each one of them is tipped with phosphorous . . . with a crisp benefit appeal, sure-fire enough to make you light like a match . . . WITH YOUR FIRST SENTENCE!



1—LAYING THE GRIDS for burial in the sidewalks of New York. Tight gas-welded joints keep the circulating hot water from leaking

2—UPPER sections of pipe and elbow were cut out to weld the bottom portion

No Snow Next Winter!

Radiant heat will melt snow and de-ice the sidewalks around New York's new 100 Park Avenue building. Grids for the system are gas-welded steel piping

BY J. M. HELLER
Technical Sales Supervisor, Air Reduction Sales Co.

SHOVELING snow off the sidewalks is as much a chore for the large office building as it is for the small home. Also, the office building has to figure out what to do with the snow. Radiant-heated sidewalks solve both problems at the same time.

The new 100 Park Avenue building, a 36-story skyscraper just built near the Grand Central Station in New York City, will be de-iced and de-snowed next winter by hot water circulating through all-welded pipes built into the sidewalk. The radiant-heating grids were installed by the contracting firm of Kerby Saunders, Inc., under subcontract from the George A. Fuller Co., the building contractor.

A mixture of water and anti-freeze (40% ethylene-glycol) will be pumped under a pressure of 40 psi through a series of grids connected to the supply and return headers. The circulating fluid is kept at a temperature of 168 F by running it through a heat exchanger that is heated by steam from the building's steam mains.

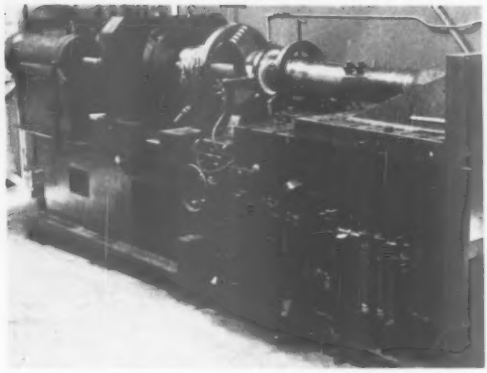
The system is designed to keep 10,000 sq ft of sidewalks free from snow when it's snowing.

Each grid section is about 22 ft long. The grids were partially prefabricated in the piping contractor's shop, brought to the site and welded to the supply and return mains (Fig. 1.). Concrete was poured over the pipes to just cover the tops of the grids as they were installed. A wire mesh was then laid over the embedded piping before the final 2½ in. layer of cement was poured. Purpose of the wire mesh is to aid in the heat transfer and to prevent the cement from cracking because of heat stresses.

1,100 Joints Welded

Altogether, 1,100 welded joints had to be made on 9,000 linear feet of piping. The grids are ¾-in. extra-heavy steel pipe; the headers are 1¼-in. pipe of the same material. All of the joints were gas welded with AWS GA60 mild-steel welding rods. Gas welding was used instead of arc welding because with small-diameter pipe the welding torch and filler rod are easier to manipulate than the electrode. Gas welding was used instead of silver brazing because of the type of construction. Silver brazing would have required a series of T-joints to connect the grid pipes into the headers, whereas gas welding made it possible to use the more economical butt joints. These considerations, however, must not be assumed to hold true for all piping installations: each layout must be individually analyzed.

An interesting operation is shown in Fig. 2. The top portions of the elbow and the header were cut out to allow the bottom portions to be welded together. The pieces cut out were then welded back in order to complete the joint. This complicated way of doing it was necessary because the rigidity of the pipe grid made it impossible to get at the underneath part with the welding torch. The use of silver-brazing fittings might have been an easier way for these few special connections.



1—PRESS for "Uniwelding" is provided with gages, controls and fixtures to hold the parts in alignment

2—MACHINED faces of the parts are butted together. Largest qualified weld: tube 15⅜-in. OD, 1⅜-in. wall

Pressure Welds with

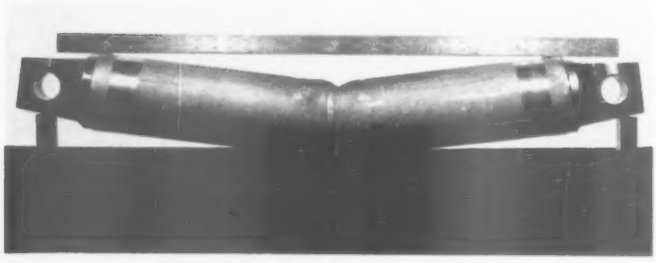
LANDING GEAR represents between 3% and 7% of the total weight of a modern airplane. Anything that saves weight will make money for the air lines. On one of the world's largest transport planes, for example, a gear built with Uniwelded joints saved a weight of over 1,000 lb—half a ton that can be used for payload.

NOW WHAT'S UNIWELDING? It's a refinement of the pressure-welding process (oxyacetylene) that joins railroad rails and piping of large diameter. Among other advantages:

UNIWELDING GIVES the designer a joint (for the first time) that needs no special allowance in stress calculations. The joints are made at forging temperatures without adding filler metal. Structurally, the weld is identical to the base metal.

BY L. VAN CAMP WITH C. E. LEVOE

Chief Metallurgist and Welding Engineer, respectively, Menasco Manufacturing Co., Burbank, Calif.



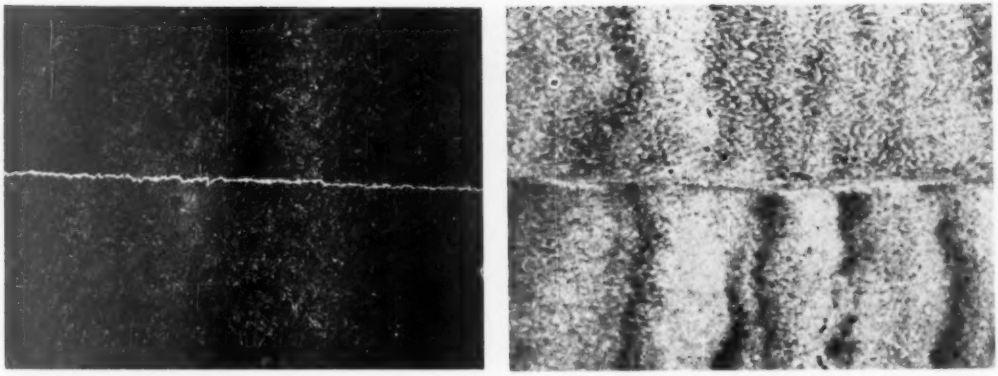
4—BEND TEST is the most critical when ratio of outside diameter to wall thickness is less than 20. Welded samples are tested to destruction

IT ISN'T easy to find steel for the landing gear of very large aircraft. Forgings for the main cylinders and pistons of the very large modern gear are sometimes so huge that there simply aren't forging hammers big enough to handle them. Even if the hammer exists, it's next to impossible to forge steels of aircraft quality in large sizes because of the difficulty of obtaining reduction from the ingot. The obvious answer is to fabricate large landing gear from smaller forgings joined by welding. There is ample hammer capacity for the smaller forgings, and aircraft-quality steels are readily available for them.

Use Pressure Welding

At Menasco Mfg. Co., Burbank, Calif., we utilize pressure welding to join large tubular sections together to make aircraft landing gear. The company's "Uniwelding" process was the subject of a previous article in THE WELDING ENGINEER ("Pressure-Welded Aircraft," July, 1948). The writers feel, however, that new developments and later information justify a sequel on this method of producing 100%-strength welds.

Uniwelding gives the designer for the first time a joint that needs no special allowance in stress calculations. The technique is a refinement of the oxyacetylene pressure-welding



3—METALLURGICAL samples are sectioned, etched and examined for quality. Thin, white line in sample at left indicates a high concentration of oxygen; weld would be rejected. The sample at right shows an acceptable weld

Parent-Metal Strength

process used to join railroad rails and large-diameter piping. The joints are made at forging temperatures without adding filler metal. Thus the metal at the weld is not altered from that of the base metal: structurally (and in response to heat treatment), the weld is identical to the base metal. Since no reinforcement is needed at the weld, there is no increase in weight over a non-welded structure.

Steels generally used for highly stressed members of aircraft landing gear are the SAE 4100 and 4300 series or equivalent NE steels. These possess good ductility when they have been heat treated to the 180,000 to 200,000 psi range of ultimate tensile strength.

Pressure welding is capable of producing welds in any size and in any shape. Simple tubular sections are the easiest to weld, and the bulk of the development has been in these tubular shapes. The Uniweld process has been successful with joints of less than one square inch and with those of approximately 60 sq in. of cross-sectional area. The largest weld qualified to date at Menasco was in a tubular section of 15⅜-in. outside diameter and wall thickness of 1⅜-in. This has a cross-sectional weld area of around 31 sq in.* Present equipment is designed to produce a weld with a maximum of 100 sq in. of cross-sectional area.

*Area of OD = 185 sq in. Area of ID = 154 sq in. Difference = 31 sq in.

Dead Weight Into Payload

Landing gear alone accounts for between 3 to 7% of the total weight of a modern airplane. It is easy to see why the weight-saving ability of Uniwelding makes money for air lines. For an example, let's look at the landing gear of one of the world's largest transport airplanes. A Menasco-built gear with Uniwelded joints saved a weight of over 1,000 lb per airplane. That's half a ton that can be used for payload.

Like pressure welding generally, Uniwelding is done by forcing together the parts to be welded while heating the area of the weld. Pressure and heat keep up until sufficient upsetting (or forging) takes place. The essentials are: (1) intimate contact of surfaces to be welded (secured by machining the butting faces); (2) heat; (3) pressure; (4) exclusion of air between the weld faces. It is likewise important to exclude any material that might cause a physical or chemical discontinuity.

Bonding is effected theoretically by atomic attraction due to intimate contact of the weld surfaces. In a practical sense, though, hot working (upsetting) is the agency that effects the cohesion. Hot working also breaks down inhibiting films on the weld faces and allows recrystalization across the weld plane. Further reorientation of grains is produced by the transformation that takes place during heat treatment.

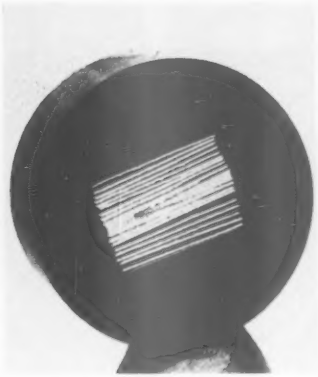
The equipment required is essentially a hydraulic press (Fig. 1) equipped with holding fixtures, an oxyacetylene heating head and a device to measure and control the amount of "gather" (shortening of the parts due to upsetting). Menasco's largest Uniwelding machine is designed so that the movable carriage is loaded by two hydraulic pistons moving in a plane through its center line. Such axial or straight-line loading minimizes misalignment.

The Heating Head

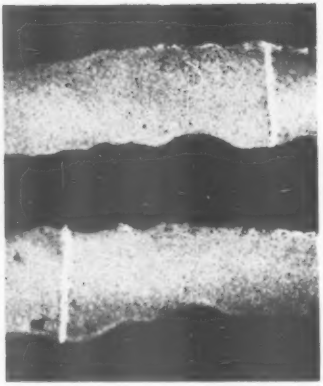
Principal requirement of the heating head is to produce a high temperature in the two abutting faces of the parts at a rate suited to the particular section. The linear heat gradient, both straight-line and radially, must also be considered so the weld faces won't open up because of different thermal expansions. The heating head is usually oscillated sidewise to distribute the flames over a larger area. This back-and-forth movement not only transfers heat efficiently but prevents the metal beneath the flame tips from becoming overheated.

Other accessory control equip-

5—CURLED CHIP is cut with a flat tool from the internal upset



6—MOUNTED, the chip is ground to expose several cross-sections



7—ETCHED chip is examined for oxygen concentration (white lines)

ment includes oxygen and acetylene flow-meters, regulators and pressure gauges. The extent of upsetting is controlled by a limit switch. This automatic device turns off the hydraulic pressure and fuel gas simultaneously as soon as the required amount of gather occurs.

How It's Done

The parts to be welded (Fig. 2) are machined to a smooth finish on the weld faces. They are located in the machine by fixtures that provide accurate alignment. The operator sets the controls to apply upsetting pressure before he lights the heating head. The concentrated flames in the heating head help to limit upsetting to a relatively small amount. When the specified shortening takes place, the gather control shuts off the heat and pressure. The part can be removed immediately from the machine and parts loaded for another weld. Welding time depends on the wall thickness of the tube; it may be anywhere from a few seconds to several minutes. An average weld time for a tube with $\frac{1}{4}$-in. wall is about two minutes.

We may get our preliminary estimate of machine settings for qualifying a new-size joint from prediction curves. Then we weld samples for metallographic examination, also samples for mechanical testing. Tests have demonstrated an extremely good correlation between microscopic examination and weld strength provided that all factors are taken into consideration.

Pertinent factors in the examination of the preliminary samples are: (1) depth of fissure in the internal upset, (2) depth of burned metal in the external upset (both upsets must be shallow enough to be machined off), (3) a grading of oxygen content and concentration at the weld. Oxygen content and concentration, as revealed by etching in alkaline chromate, have been directly correlated with the strength of the joint (Fig. 3).

On the basis of the examination of preliminary (metallurgical) samples, six to eight physical test samples are welded. For these, we use the machine settings that provided the most satisfactory metallurgical weld. The samples are machined to leave approximately 0.015 in. of internal upset; they are turned flush on the outside. Before testing, they are heat treated to an indicated tensile strength equal to that specified for the production parts.

We base the acceptance of the joint on the mechanical test results we obtain. Bending is the main stress in most aircraft landing gear parts so the bend test (Fig. 4) is important. It is considered the most critical test for welds in which the ratio of outside diameter to wall thickness is less than 20. For D/t ratios of greater than 20, the most critical test is tension testing, either of coupons machined from the tubes or, when possible, testing of full tubes.

Data on machine settings, time and amount of gather are taken for each weld and telescoped into a permanent weld number stamped on the part.

Menasco Process Control

We at Menasco attribute a major part of our success in pressure welding to process control. It is necessarily quite rigid to insure consistent 100%-strength joints. For the past three years, a rather unique inspection has been applied to each open assembly. First, we machine the internal upset almost to finished size; then we remove a tightly curled chip (Fig. 5) from inside with a special flat tool. This chip is approximately 0.015 in. thick. It is mounted in Bakelite (Fig. 6) and ground and polished so that several cross-sections of the curl are exposed. The surface is then etched with alkaline chromate and examined for oxygen concentration. The chips shown in Fig. 7 indicate excessive oxygen concentrations (white lines).

Our experience is that the poorest portion of a Uniweld is on the inside; by examining a sample of this poorest portion, the quality of the entire weld can be properly judged.

We believe that over the past eight years we have brought the process to near perfection. Furthermore, we predict a bright future for Uniwelding in the manufacture of aircraft landing gear. Higher landing speeds and greater gross weights are a tendency of modern aircraft. Manufacturers more and more demand the highest possible structural efficiencies from landing gear at the least obtainable weight.

Welding in the Law Courts

During the past few months the higher courts in different states have rendered important decisions affecting manufacturers, sellers and users of welding equipment. Quite obviously, knowledge of these leading higher court cases will assist readers of THE WELDING ENGINEER to prepare to avoid expensive lawsuits. Also, these leading cases may be advantageously used by readers to win suits that can't be avoided. Mr. Parker presents a quick, easy-to-read summary of legal facts you ought to know.

BY LEO T. PARKER
Attorney at Law, Cincinnati

LAW OF PATENTS

"Mechanical skill is one thing: invention is a different thing . . . An instrument which is the result of mechanical skill merely is not patentable."

It is important for all persons engaged in manufacturing, selling and using welding equipment to have a dependable rule for determining whether or not a valid patent may be obtained on a particular invention. Here is a dependable 10-point rule to avoid wasting money in filing applications for *void* patents:

Don't file an application for a patent on: (1) a mere idea; (2) a mere result; (3) a property of matter; (4) an aggregation of old parts which do not act together to produce a *unitary* result; (5) a system for doing something; (6) things invented by mere "mechanical skill" and which don't require "inventive ability"; (7) devices that are inoperative or impractical; (8) a scientific principle which affects a new purpose; (9) devices that are not new and useful; (10) things which have been described in any magazine or publication or previously patented in this or any other country.

Particularly, a great many patents on welding equipment have in the past been held void on the basis of No. 6 of the above rule. In other words, an improvement to be patentable must be the result of *invention* and not the mere exercise of what the court calls "mechanical skill."

For example, in Illinois Welding Accessories Company v. Johnson Welding Equipment Company, 161 Fed. (2d) 624, the testimony showed facts, as follows: The Illinois Welding Accessories Company owns patent No. 2,056,043 for coil spring covers on an electrode "holding device" in which a pair of clamping jaws are normally spread apart when the handles are depressed. There is a coil spring between the jaws to close the latter into clamping position. When the handles are depressed, the spring likewise is depressed; when the jaws are closed, the spring is extended. An inventor obtained a patent on "protective means" for enclosing this coil spring. This means comprised a pair of telescopically arranged tubes formed of heat-insulating material. The tubes are fixed to the respective jaws and are movable when one jaw is moved with respect to the other.

The Illinois Welding Accessories Company sued the Johnson Welding Equipment Company for infringement of this patent. In holding the patent void, the higher court said:

". . . Mechanical skill is one thing: invention is a different thing. . . . An instrument or manufacture which is the result of mechanical skill merely is not patentable. . . . We conclude that there is nothing in any of the claims patentable over the prior art and that the claims merely carry forward old ideas merely changed in proportion or degree and embracing additions and modifications that would suggest themselves to any skilled mechanic. This does not amount to invention."

PERSONAL INJURIES

"The verdict is undoubtedly high. Nevertheless, it is not the function of a reviewing court to interfere with a jury's award of damages."

According to a recent higher court, a weldor may perform work in a dangerous place and yet receive damages from one who negligently injures him.

For example, in Hedding v. Pearson, 173 Pac. (2d) 382, a weldor named Hedding was welding a steel plate located in a driveway. A truck entered the driveway and ran over Hedding's legs. The injured man sued the owner of the truck for damages.

The lower court held the owner of the truck not liable, but the higher court reversed the decision and said:

"It is quite evident that Zentz (truck driver) knew, or in the exercise of reasonable care should have known, that plaintiff (Hedding) was working in the driveway in close proximity to the front of his truck."

$87,575 Damage: Modern higher courts consistently hold that neglect of an employee may result in heavy financial loss to his employer.

For illustration, Johnson v. Long, 180 Pac. (2d) 21, the higher court awarded a man named Johnson $87,575 damages for injuries received when an overhead door fell on him. He proved that an employee had repaired the door and did not securely fasten or weld the ends of the cable to prevent it from unwinding.

The jury granted Johnson $87,575 damages. The case was appealed, but the higher court approved the verdict and said:

". . . The verdict is undoubtedly high. Nevertheless, it is not the function of a reviewing court to inter-

fere with a jury's award of damages unless it is so grossly disproportionate to any reasonable limit of compensation warranted by the facts that it shocks the court's sense of justice and raises a presumption that it was the result of passion and prejudice."

Carbon Monoxide Death: According to a recent higher court, dependents of an employee will be awarded compensation based on death by carbon monoxide poisoning while attending to his regular work if the decedent's face had a cherry-red hue.

For example, in Jeffersonville Machine Company v. Rager, 65 N. E. (2nd) 638, it was shown that an employee entered the wing tank of a boat to test the welding for leaks. There were in this wing two five-gallon buckets or "salamanders" for the burning of coke for heating purposes. Later, a fellow workman called down and received no answer. The employee was found dead, lying flat on his back, and his face had a cherry-red hue.

In view of this testimony, the Industrial Board decided that the employee had died from carbon monoxide poisoning and awarded the widow compensation. The higher court approved the award and said:

"There is direct evidence of the presence of decedent's body and body reactions of a cherry-red hue on the face, skin and internal organs which is characteristic of carbon monoxide poisoning."

DON'T LOAN WELDERS

"He assumed the responsibility to be liable to anyone injured."

A higher court held recently that it makes no difference how, when or under what circumstances a person who borrows welding equipment is injured, he can recover damages from the lender.

For example, in Bonvillian v. Willis, 26 So. (2d) 25, it was shown that the owner of a service shop loaned equipment to a friend. Due to a defect in the equipment, the friend was seriously injured, and he sued the owner of the service shop for damages. The higher court held the latter liable for $42,350 damages and said:

"He (the shop owner) assumed the responsibility to be liable to anyone injured."

The court explained that one who loans or rents equipment or tools has a legal duty to notify the borrower of any and all defects, otherwise he is liable in damages for injuries sustained by the borrower.

CAN RESTRICT DAMAGES

"The Southern Company shall not be responsible for damages in use of this machine."

All courts agree that a purchaser of welding equipment may include in a contract a valid restriction. If no law is violated, the restriction is valid and binding on the seller. Also, a seller may limit his liability by inserting a handwritten clause in the contract even though he (the seller) breaches his printed guarantee.

For example, in Morton v. Southern Company, 130 S. W. (2d) 1065, it was shown that a seller inserted in a printed contract of sale a pen-written clause, as follows:

"The Southern Company (seller) shall not be responsible for damages in use of this machine. . . ."

The purchaser sued the seller and proved that the equipment would not perform as guaranteed in the printed body of the contract. However, the higher court refused to award any damages to the purchaser, saying that the seller's pen-written clause rendered the printed guarantee clause void.

In the case of Wilson, 256 N. Y. 93, it was shown that a seller printed on the contract, the following:

"We give no warranty, express or implied, as to description, quality . . . and will be in no way responsible. . . ."

The higher court held that this clause relieved the seller of all guarantees.

LIABLE FOR NEGLIGENCE

"One who has received an automobile for the purpose of repairing same is liable to the owner for any damage caused by his negligence."

All courts agree that the owner of a welding shop is liable for negligence of an employee doing welding work.

For illustration, in Wood v. Becker Welding Shop, 34 So. (2d) 924, the testimony showed that a man named Wood had brought his Buick four-door sedan to the Becker Welding Shop to have a cross member welded. An employee of the welding shop allowed a welding torch to come in contact with the gasoline tank of the automobile, which caught fire and was seriously damaged. Wood sued to recover damages.

The higher court held the Becker Welding Shop liable to Wood for $359.42, saying:

"The testimony shows clearly that the weldor allowed the flame of the welding torch to come in contact with the gas tank. . . . One who has received an automobile for the purpose of repairing same is liable to the owner for any damage caused by his negligence."

NO EXEMPTION

"The ordinary contract exempting a person from liability for the consequences of his negligence is void, as against public policy."

All contracts exempting a person from liability for consequences of his negligence are void.

In Nash Company v. Noyes Company, 41 Atl. (2d) 920, the testimony showed that one Nash had leased a storage space. The lease contract contained a clause that Nash would not hold the landlord liable for loss or damage.

An employee of the landlord while using an oxyacetylene torch permitted sparks to drop on combustible materials. The fire thus started destroyed the building and Nash's stock of goods valued at $75,000.

The question presented the court was whether the above clause in the lease contract relieved the landlord from $75,000 liability to Nash. In holding in the negative, the higher court said:

"The ordinary contract exempting a person from liability for the consequences of his negligence is void, as against public policy."

UNEMPLOYMENT PAY

"Unless claims are critically examined and unconscionable requisitions upon the fund firmly rejected, public opinion will not support the law."

Modern higher courts consistently hold that a weldor may receive com-

pensation under State Unemployment Compensation Act only if he has "good cause." In other words, he must accept suitable employment or be denied compensation.

In Department of Industry v. Unemployment Compensation Board of Review, 49 Atl. (2d) 260, it was shown that one Bril was employed as a spot weldor. He was laid off because of the termination of work. He applied for benefits, under the State Unemployment Compensation Act, registered for work and soon afterward was referred to two prospective employers. The wages offered were considerably less than he had been receiving. He rejected both referrals without interviewing the referred employers, and the bureau denied his claim for unemployment compensation. The higher court refused to award compensation, saying:

"The attitude of this claimant, disclosed by actions, lacks the essential ingredient of good faith. His refusal of referrals without interviewing the employers indicates an application for a vacation rather than for work. . . . Discerning administrators of unemployment compensation have already discovered that unless claims are critically examined and unconscionable requisitions upon the fund firmly rejected, public opinion will not support the law."

G. I. IS KILLED

If a G. I. weldor is killed or injured while on government training, what compensation can be drawn?

In Wood Mercantile Company v. Cole, 209 S. W. (2d) 290, it was shown that a G. I. named Cole began employment with the Mercantile Company about six months after his discharge from the army. He had qualified for United States government subsistence payments under the G. I. Bill of Rights and was training to be a weldor with the Mercantile Company. Cole's beginning wage was $50 per month, and the company's officials had agreed that at the end of each six months' period of employment his wages would be increased until a wage of $172.80 per month was reached at the end of a 36-month training period. In addition to the $50 per month from the Mercantile Company, Cole received a subsistence payment of $90 per month from the government, bringing his total income to $140.

Cole was killed while on the job. The court was asked to decide on what salary basis compensation under the State Workmen's Compensation Act should be paid to Cole's dependents. The court held:

"The only question presented is: What was the average weekly wage of Cole at the time of his accidental death? . . . The subsistence allowance of $90 per month paid to Cole by the government must be considered as part of Cole's wage within the meaning of the compensation law and when this sum is added to $50 per month paid by the Mercantile Company, Cole's total wage was $140 per month, which entitled the claimants to compensation at the rate of $20 per week."

FAIR LABOR ACT

Employees paid to experiment and executives are not within the scope of this law.

According to new law, all employees who are "indispensable" in production or distribution of merchandise for interstate commerce must be paid minimum wages specified by the Fair Labor Standards Act. However, according to a recent higher court, employees who are employed to "experiment" are not within the scope of this law.

In Krill v. Arma, 76 Fed. Supp. 14, it was shown that one Krill did experimental work, constructed experimental models and tested welding equipment. He sued his employer to recover overtime and back wages under the Fair Labor Standards Act. In refusing to hold in favor of Krill, the higher court said:

"The plaintiff (Krill) must fail because he was not engaged in commerce or in the production of goods for commerce within the meaning of the Act."

Also, this court held that executives are exempt from the Fair Labor Standards Act.

"Will the Senator from Iowa kindly let the man weld in his own way?"

SILICOSIS DISALLOWED

A weldor who sues for compensation under the State Workmen's Compensation Act must prove that the injury or death actually was within the scope of the employment.

In Jaloneck v. Jarecki, 43 Atl. (2d) 431, it was contended that an employee had contracted silicosis while grinding castings and doing welding work and had died of the disease. His dependents sued to recover compensation under the State Workmen's Compensation Act. The employer denied that deceased's death was the primary result of silicosis.

Since the dependents failed to prove that the death of the employee was caused by silicosis contracted during the employment, the higher court refused to allow compensation.

LAW OF FOREMEN

An ordinary employee cannot recover damages or compensation for an injury sustained while "off the job," but this rule of law is not applicable to foremen.

In Hohman v. Soffel Company, 46 Atl. (2d) 475, it was shown that a foreman had no regular place of work but went from one welding job to another as directed by his employer. He used his own automobile, for which he was reimbursed by the employer.

One morning the foreman started from his home in his automobile taking with him materials which he had at his home to do a repair job that day. On his way, he was killed.

The higher court awarded compensation, saying:

"The service of the employer's interest in the circumstances shown necessarily made of the claimant a 'roving' or 'itinerant' workman."

BY WILLIAM C. HENZLIK

Cabinets Reinforced

- **Extra strength and rigidity that a quality item deserves are given to Harrison steel kitchen cabinets by welding the corners and joints with the carbon arc.**
- **For 54 carbon-arc welds, the actual welding time is less than five minutes. Speed is attained because of the low melting point of the copper-silicon filler rod.**
- **Drawer guides are also brazed with the carbon arc. This adds rigidity, eliminates any possibility of drawers getting out of line because of loosened screws.**

KITCHEN CABINETS of heavy-gauge steel are fabricated entirely by resistance (spot) and carbon-arc welding at the Harrison Steel Cabinet Co., Chicago. Not a single screw or bolt is used to attach shelves, partitions, sides or backs.

E. J. Polland, general sales manager of the plant, says that the sales appeal of Harrison cabinets lies in their reputation for consistent performance, durability, beauty and low maintenance cost. Welded construction affords all these features, Mr. Polland says, and welding is the most efficient production method the company ever used.

Harrison cabinets are divided into base cabinets (those with tops at waist level) and wall cabinets (mounted above head level). The great majority are standard sizes, ranging in widths from 15 to 30 in. Undersink cabinets—used to store pots, bulky groceries and kitchen utensils—come in standard 36-in. heights and in depths ranging from 20 to 25 in. Refrigerator-cabinet-sink combinations measuring 42 by 25 in. are offered for small apartments. Sink tops and bowls are also made in standard sizes and can be fitted with cabinets into special patterns to fit individual kitchens. If the lady of the house desires, Harrison will give her kitchen a "custom" appearance by fabricating a one-piece top, of brightly colored formica, linoleum or shiny stainless

1—HARRISON STEEL kitchen cabinets are durable, easy to clean and attractive to the eye. Shiny surface on base cabinets is formica covering

3—BLANKED-AND-PUNCHED sheets are given multiple bends with one handling operation by means of step gauges on the press brakes

4—CHANNEL is spot welded to inside panel to stiffen and strengthen a door

2—BRAZING JOINTS and corners with carbon arc and copper-silicon rod. Average-size sink-and-wall combination has a total of 54 carbon-arc welds

by Carbon Arc

steel, to fit over the base cabinet units (Fig. 1).

Shearing, Punching, Forming

Cold-rolled prime steel and hot-rolled pickled steel are the materials used in cabinet manufacture. Harrison has its own tanks for pickling steel plate. Thickness of the sheet steel varies from 18 to 22 gauge; linoleum cabinet tops are fabricated of 14 and 16 gauge steel.

Production begins on the plant's second floor, where blank shapes are cut with large precision shears. The present production level requires eight shears. Shearing is followed by punch-press operations to punch out the needed openings. Consolidated notching dies insure high accuracy. The company's own tool and die department makes all the dies, including special models for custom orders or for other purposes. New dies can be made whenever they're needed to improve cabinet design or speed production. The blanked-and-punched sheets next pass to press brakes (Fig. 3), where they are given multiple bends with a single handling operation through the use of special step gauges on the brakes. Multiple bending avoids double handling, saves time and money. Production runs of 200 to 250 units are standard for the side, shelf, back and top sections of cabinets.

Ten Seconds for Brace

Harrison is proud of its sturdy doors and drawer fronts. The secret is a steel channel section spot welded to the inside surface of the inner panel. Four spots on each flange of the channel are welded by a 15-kva automatic spot welder (Fig. 4). The entire operation, including the handling, loading and unloading of the panel, takes only ten seconds. A sound-deadening gooey compound is applied with a spray gun to the inner side of the outside panel. This mastic compound is similar to that used for undercoating automobiles. It is applied to the outside panel before it is fitted to the braced panel. The channel stiffener is forced into the sticky mastic as the panels are fitted. This type of contact between panels eliminates the metallic sounds that annoyed owners of earlier metal cabinets.

Once the inner and outer door panels are fitted, they must be fastened securely. At Harrison, this is done by brazing the radius corners with an oxyacetylene torch, using a 3/32-in. brass filler rod. The operator in Fig. 7, Ralph Terracina, has worked out a high-speed brazing technique and fast handling method to earn himself a bonus equal to 80% of his salary.

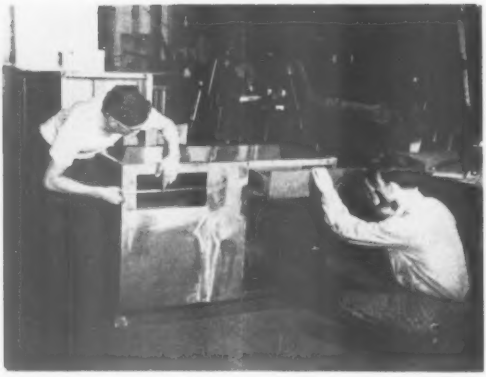
Brazed joints on the corners of the door are finished with a continuous-belt grinder. Any mars or traces of the spot welds on the panel brace are ground off or buffed with portable electric grinders.

Spring-loaded hinges keep the doors completely open or tightly closed. These spring hinges are attached to the assembled doors before they go to the cabinet assembly line. The hinge is a self-contained unit, fastened to the door with three self-tapping screws. It does away with the old-fashioned friction catches on the inside of the door. Replacement hinges can be installed by customers without special tools.

5—MAGNETIC JIG holds drawer guides inside frames of cabinets

6—CARBON ARC welds the drawer guides. Jig is easily withdrawn

7—THIS WELDOR earns a bonus because he developed high-speed practices for brazing curved door corners



8—CUSTOM-BUILT base cabinet. Laundry chute entrance at left; special cutlery drawer at the right

Sides, backs, shelves and tops of the wall cabinets are assembled by spot welding on welders of 15 to 20 kva rating. Thanks to the precision blanking and punching, little jigging is required: all that is necessary is to hold the parts rigidly during welding. The sections are light enough to be loaded manually into all the spot welders.

Carbon-Arc Brazing

All joints and corners of cabinets are reinforced by brass beads laid with the carbon arc. A single carbon electrode is used (Fig. 2). This method of reinforcing has been found to offer advantages of speed, flexibility and reliability at comparatively low cost. The filler rod is a copper-silicon alloy rod offering the advantage of a low melting point.

In less than a minute, four reinforcing welds are put on the average wall cabinet. Base cabinets (especially those for use under a sink) may have as many as 42 carbon-arc welds; in sink-and-wall cabinet combinations, there may be 54. Even for the 54 welds, actual welding time is less than five minutes.

Carbon electrodes are 5/32 in. in diameter; the brass filler rod is 1/8 in. A current of 150 amp is supplied from a motor-driven d-c generator.

Cabinet doors, drawers and shelves must be interchangeable. Not only are the drawers all made of identical dimensions, but the guides on which drawers run must be exactly placed in each cabinet. To secure this precision, jigs must be used.

A magnetic jig designed by Superintendent Vincent Russo deserves special mention. Inventor Russo is shown holding it in Fig. 5. Four permanent Alnico magnets bolted to the corners of the jig hold two drawer guides for a base cabinet in correct lateral relationship.

Frames and jigs are inserted into the cavity in the cabinet. The weldor makes his brass reinforcing and attaching welds (Fig. 6), again with the carbon arc, and the jig is quickly withdrawn. Speedy removal is made possible by the sliding magnetic contact.

Cabinet drawers slide easily because of roller bearings. These are fitted into grooves in the drawer guides.

Custom Cabinets

Talents of the most highly skilled workers in sheet metal are called upon to fabricate such "tailored-in-steel" cabinet units as the one shown in Fig. 8. This model features a swing panel in conjunction with a laundry chute (left of picture). A special cutlery drawer is on the right.

A work order sheet is written for each special cabinet. It includes small sketches of the parts, gives the number of pieces and specifies dimensions. The custom department has its own spot welders, any one of which may be used to assemble the special components. Offset tips and offset electrode holders are sometimes necessary.

Joints on the custom cabinets are reinforced as easily as those on the standard units and in the same manner. The flexible carbon-arc process enables the application of the brass beads to just those areas considered highly stressed.

Painting and Assembly

Parts or subassemblies for a particular wall or base cabinet are hung in sequence on an endless conveyor chain. Gun operators spray three separate coats of enamel as the assemblies pass them on the conveyor chain. The first operator sprays the back of the cabinet; the second man covers the front. Third and fourth operators apply the intermediate coat; then two finish sprayers add the final smooth coating.

The cabinets continue through a baking oven that keeps them at a temperature of 340 F for thirty minutes. No other drying time is required. As the parts emerge from the oven, they are removed from the conveyor chain for assembly. Drawers are fitted into cabinets; doors are hung and fitted; rubber bumpers are set into place, etc.

For storage and shipment, the cabinets are put into special "pressure-pack" cartons where they rest against wax surfaces to prevent scratching of the enamel. The heavier under-sink cabinets are packed into wooden crates.

Other Harrison Steel Cabinet Company products are automatic gas water heaters, radiator enclosures, shower stalls, special hospital cabinets, gas and oil space heaters, file cabinets, other office equipment. The firm, a subsidiary of Harrison Sheet Steel Co., has four plants, all in Chicago.

C. E. MONLUX, Linde Air Products, was elected IAA president

JAMES I. BANASH (right) receives Morehead medal from J. J. Lincoln of Airco. Banash earned the high honor by his many years of safety work

IAA *Holds 50th Meeting in San Francisco*

BY T. B. JEFFERSON

THE THREE-DAY 50th annual meeting of the International Acetylene Association was packed with factual information. The time was March 27, 28 and 29; the place the Fairmont Hotel, San Francisco. All phases of the use of oxygen and acetylene combinations in the welding field were covered, also the use of oxygen for aviation and medical purposes.

MOREHEAD MEDAL TO BANASH

Highlight of the highly successful meeting was, perhaps, the opening luncheon on Monday, March 27. On this occasion James I. Banash, consulting engineer, Chicago, was awarded the James Turner Morehead medal for "many years' stimulating inspiration, guidance and encouragement of the acetylene industry towards higher safety achievements." The presentation was made by J. J. Lincoln, Jr., of Air Reduction Sales Co., and past president of IAA.

Mr. Banash, one of the best known and best liked men in the industry, has for over 40 years been associated with the safe uses of oxygen and acetylene. He is one of the founders of the American Welding Society and is also a past president of the National Safety Council.

C. E. Monlux, vice-president of IAA, presided over the luncheon and introduced the guest of honor—Mayor Elmer E. Robinson, of San Francisco. In his speech of welcome, Mayor Robinson pointed out that his city's new construction plans call for spending over $300,000,000.

IAA President A. J. Fausek, Modern Engineering Co., talked briefly on "What Constitutes Our Security." He indicated that "a fuller appreciation of past accomplishments would make possible a better and more secure life. These past accomplishments were not given to us but are the result of hard work."

PRAISE FROM THE ARMY

Principal speech of the luncheon was that given by the Hon. Karl R. Bendetsen, Assistant Secretary of the Army. Secretary Bendetsen gave a glowing account of the part played by welding in World War II. Said he: "World War II might and probably would have lasted many years, with enormously greater suffering and loss of human life, had it not been for this country's phenomenal achievements in war production made possible by welding."

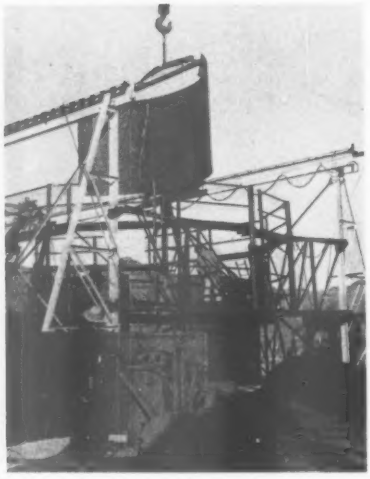
In world affairs, Secretary Bendetsen pointed out, "We are finding the answer to survival in all four fields of strategy: political, economic, psychological and, to a permissible extent, in the military."

MONLUX ELECTED PRESIDENT

As IAA vice-president, Claude E. Monlux was naturally in line for the succession. He was elected president at the annual business meeting, held at the close of the convention. Mr. Monlux is vice-president of The Linde Air Products Co., New York City. James W. Dunham, vice-president, National Cylinder Gas Co., Chicago, was elected vice-president. Re-elected to office were: E. V. David, assistant manager of the

(Continued on page 54)

1—CURVED PLATES were preformed in Los Angeles, preassembled, match-marked and disassembled. They were then trucked to the site



2—CRANE HOISTS three plates to a vertical assembly jig for tack welding

Penstock Production Line

Whether your welding jobs are small or large, they can be expedited by a well organized flow of products or materials. Even when the problem is to fabricate 20-ft-long sections of 22-ft diam penstock

BY JIM JOSEPH

YOU wouldn't think of looking for a big-pipe production line in the desert, would you? Well, five complete 22-ft.-diameter penstocks (the longest 298 ft.) were fabricated on a 190-ft. desert production line that handled 1,700 tons of steel plate in ten months! The Southwest Welding and Manufacturing Co., Los Angeles, set up this remarkable assembly line on a 13,000- sq.-ft. concrete working area at Davis dam, on the Colorado river between Nevada and Arizona.

Under direction of Works Manager B. A. Gritzmaker, Southwest's fitting and welding crew worked for ten months to field weld approximately 1,000 ft. of penstocks and expansion joints. Some of the largest expansion joints ever constructed were required to take up the longitudinal movement between the sections embedded in the tunnels and those attached to the turbine scroll cases. The company's $1,000,000 contract also involved girth welding of the penstock sections before they were permanently embedded in the concrete of the dam's intake structure.

Form Plates in Los Angeles

Curved plates 10 ft. wide and varying in thickness from 7/8 to 1 3/16 in., were preformed in Southwest's Los Angeles shops, assembled, match-marked and disassembled for shipment. A specially designed low-bed trailer then transported six plates (20 tons) at a time to the desert site.

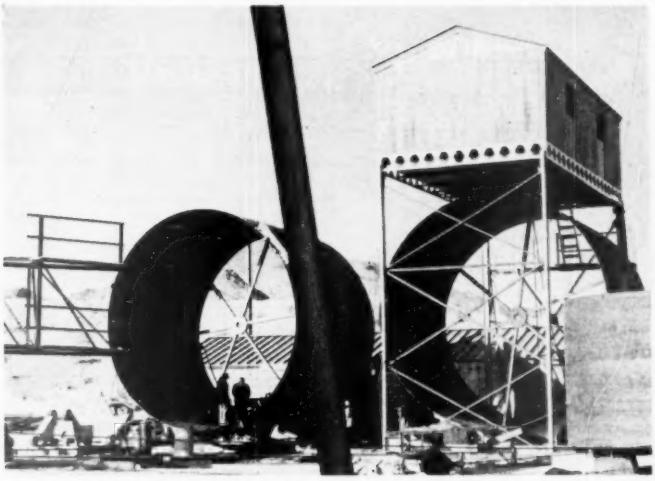
The 22-ft.-diameter penstocks were made up of sections 20-ft. long, each of which was, in turn, constructed by welding together two 10-ft. sections built of three plates each. The two 10-ft. sections were joined with their seams staggered.

A light bridge crane picked up the 10-ft. plates from the trailer, carried them to a stockpiling area near the assembly line's first stage. From the stockpile of match-marked plates (Fig. 1), a crane selected matching plates, fitted them into a vertical assembly jig (Fig. 2). Here the three plates which comprise the nearly 70-ft. penstock circumference were tack welded and tied with temporary spiders. Once the 10-ft. sections had been field welded, the next job was to join two of them circumferentially into 20-ft. lengths. These were transported to the dam, girth welded to the sections already in the tunnels and expansion joints inserted. Expansion joints weighing up to 46 tons were another problem for the field assembly line.

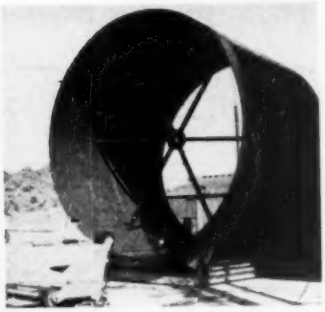
Sections Move on Cars

The desert assembly line (Fig. 3) was Southwest's solution to a tricky and bulky welding job.

First, the welding contractor poured 13,000 sq. ft. of concrete floor. Embedded in this slabbing were 190 ft. of double track, set 10 ft. apart, upon which rode cars supporting the 20-ft. pipe sections. A big 50-ton guy derrick, three expansion joint assembly stations, a penstock assembly station and a smaller crane for unloading prefabricated



3—PENSTOCK SECTION (left) receives inside circumferential weld from a submerged-melt head. Outside seams are welded from overhead house



4—ROLLS REVOLVE 20-ft-long penstock sections as they receive the inside circumferential welds

5—SUBMERGED-MELT head making the inside circumferential welds is attached to a cantilever boom

plates from trailers took up most of the remaining working area. A portable prefabricated sheet-metal building, serving as a combination office, tool room and storage space for automatic welding equipment, was set just off the assembly line. An overhead house supported by 25-ft. girders was built along the assembly line for welding of the outside circumferential seams.

Southwest's was a welding efficiency story all the way. The tack-welded 20-ft. sections were lifted by the guy derrick and set upright on power-driven rollers mounted on cars. Moving down the 190-ft. track running the length of the assembly floor, the penstocks entered a five-stage assembly line, during which they were automatically welded by submerged-melt, X-rayed, rigged with stiffeners (one every 10 ft. of penstock length) and fittings and made ready for installation at the dam.

Five Stages of Construction

Stage 1: The roller-mounted penstock was revolved slowly (Fig. 4) while automatic arc welders (submerged-arc type) completed the 70-ft. inside circumferential seam (Fig. 5). The welding head was mounted on a cantilever boom working from the prefabricated field house. Penstock and expansion joint seams involving the pipe shell and ends of stiffener rings were double-veed butt joints, welded inside and out. Inside welding required a 70-ft. circumferential seam and six staggered longitudinal welds running the widths of the 10-ft. plates.

Stage 2: When the inside seams were finished, the big pipe, still mounted on its carriage, moved under the overhead house, from which a second automatic welding head operated. This welded the outside circumferential seam and was manipulated from inside the house.

Stage 3 was the X-ray inspection station, where all seams were radiographed. Assembly-line radiographing used a slow-burning film. Defects were, of course, chipped out and re-welded.

Stages 4 and 5: Radiographing completed, a gantry-type crane moved over the pipe, installing stiffeners and fittings. Two ring stiffeners were installed around each 20-ft. section. Ring stiffeners were 1 in. wide and extended 10 in. vertically from the pipe surface. Stiffeners were fillet welded between the 10-ft. section seams.

Installation in Tunnels

Moving off the assembly line, the completed 20-ft. penstock sections were trucked to the dam and installed in the tunnels by a 50-ton overhead gantry crane belonging to the Utah Construction Co. The penstock sections were supported on permanent steel structures fabricated and welded by Southwest.

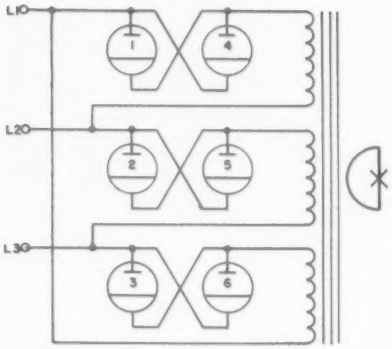
Welding of the assembled penstock was manual. The heavy bevel was on the outside upper half of the pipe and on the inside lower half, allowing the bulk of the welding to be downhand. A special mobile structural steel staging was rigged for each installed penstock, both inside and out, so fitters and weldors could reach all sections of the girth seams.

Radiographing of the final girth welds called for an X-ray machine mounted on a traveling carriage. The X-ray machine moved along the penstock's interior, shooting film-wrapped seams in quadrants from a center position. Each quadrant was of 17-ft. circumference. X-ray inspection of the tunnel seams revealed a substantially perfect welding job.

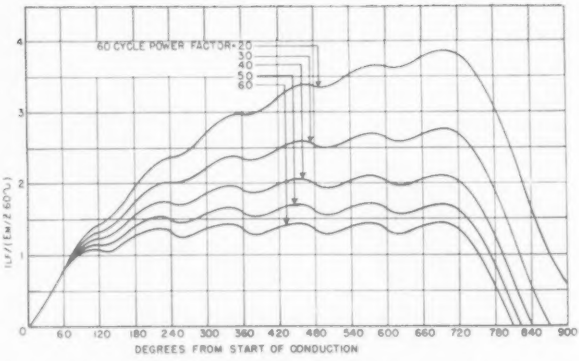
Fabrication of the ten expansion

(*Continued on page 42*)

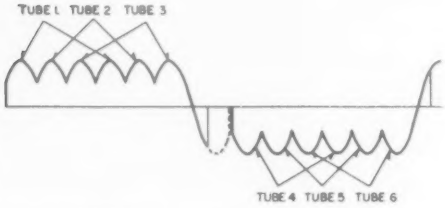
Three-Phase



1—BASIC three-phase frequency converter. Tubes 1, 2, 3 fire in sequence; afterwards tubes 4, 5, 6 fire in the opposite direction



3—SECONDARY CURRENT (welding current) in a three-phase, low-frequency system. Currents are based on "ideal" transformer in which inductance and resistance of transformer remain constant



2—ALTERNATING VOLTAGE is produced on the transformer secondary by the converter of Fig. 1

Here's what you gain when you weld with

Low-Frequency Converters*

- **Frequency converter systems lower the kva demand up to 50% of the original 60-cycle kva demand.**
- **The line currents are approximately 25% of the 60-cycle line currents on the three-phase low-frequency system and are approximately 30% to 50% on the single-phase low-frequency system.**
- **With the most recently developed electronic circuits, the welding of aluminum and magnesium will be much easier as the zero-current gaps can be eliminated. This in turn results in continuous flow of current to the weld.**
- **Ease of welding using these systems has already been demonstrated. The low rate of rise of current accounts for the increased weldability due to the decrease of "spitting" and tip pick-up in such a system.**
- **Secondary voltage and consequently the kva of the welding transformer can be further lowered by the development of the most recent electronic circuits.**

BY C. B. STADUM
Westinghouse Electric Corp., Buffalo, N. Y.

A WELDING CONTROL system with a promising future is the low-frequency converter type. In this system, line frequency (generally 60 cycles per second) from either a single-phase or three-phase source is converted into a single-phase, low-frequency current for welding. The frequency of conversion ranges between 5 and 20 cycles per second, a popular frequency being 12 cycles per second.

Three-Phase Converter

Fig. 1 gives the basic three-phase frequency-converter circuit. Tube 1 conducts first, carrying current in one direction through the welding transformer. Tube 2 then conducts current, stopping the current in tube

*Based on a paper presented at the American Institute of Electrical Engineers' summer meeting, in Swampscott, Mass., June 20-24, 1949.

1. It carries current through the welding transformer in the same direction as tube 1. Tube 3 then conducts, stopping the current in tube 2 but still carrying current in the same direction as tubes 1 and 2. The 1-2-3 sequence of tube firing is repeated as many times as necessary to obtain the proper output frequency. Firing of tubes 1, 2 and 3 results in a pulse of voltage generated on the secondary of the welding transformer that corresponds to a half cycle of welding voltage. After these tubes have fired, tubes 4, 5 and 6 fire in the opposite direction, creating a voltage loop of polarity opposite to that created by tubes 1, 2 and 3. Alternate firing of the two banks of tubes creates a low-frequency alternating voltage on the secondary of the circuit. The alternating voltage, which is essentially a square wave, is shown in Fig. 2. The current flowing in the secondary windings of the transformer is shown in Fig. 3.

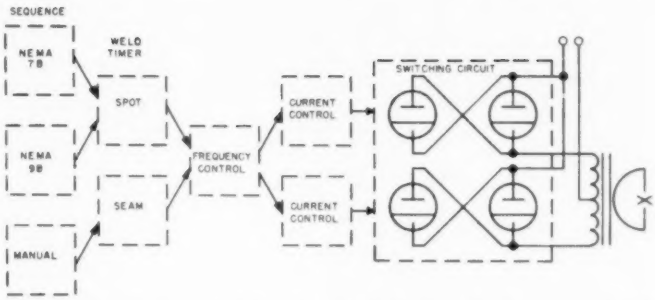
Single-Phase Converter

Another type of low-frequency converter is shown in Fig. 4. Its operation and performance are the same as the circuit shown in Fig. 1, but it operates from single-phase current. The "ripple factor" is greater than in the three-phase unit, but it uses fewer components and is consequently less costly. The currents obtained from the single-phase converter are shown in Fig. 5. (It should be noted that the currents depicted in Figs. 3 and 5 are based on an ideal transformer in which the magnetizing current is zero and the inductance and the resistance of the transformer remain constant.)

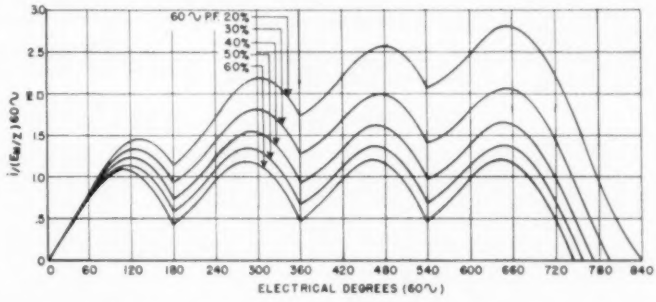
The currents shown have a rising characteristic very desirable for welding. The slow rate of rise of current allows the electrodes of the welding machine to achieve a better electrical and thermal contact with the metal before high currents appear. Results are shown in reduced spitting and tip pick-up.

Reduced Kva Demand

From a power standpoint, welding converters are desirable because they reduce kva demand. It is approximately true that the resistance of the circuit remains constant when transferring from operation at line frequency to operation at a lower frequency. The greatest gain in the reduction of kva, however, occurs not as a reduction of resistance but as a reduction of the inductive reactance, and this reduction is proportional to the reduction of frequency. As inductive reactance of the secondary circuit decreases, it takes less secondary voltage to produce the current that does the welding.



4—SCHEMATIC diagram of functions in single-phase, low-frequency control



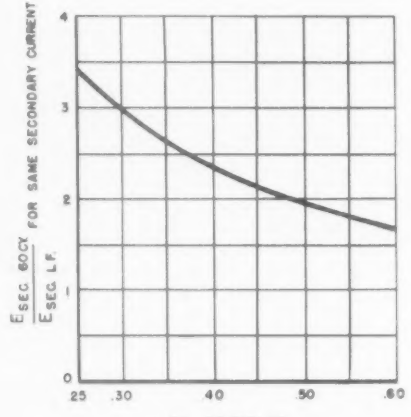
5—SECONDARY CURRENT in a single-phase system. Compare with Fig. 3

In Fig. 6, the ordinate represents the secondary voltage required by a 60-cycle system divided by the corresponding voltage required by a low-frequency system of 12 cycles per second. Power factor is represented by the abscissa. As an example, for 30% power factor the ratio is 3, which means that the voltage required for a 60-cycle machine is three times that required by the low-frequency machine. Obviously if the voltage can be lowered to a third, the kva demand for the low-frequency machine is likewise reduced to a third that of the 60-cycle machine.

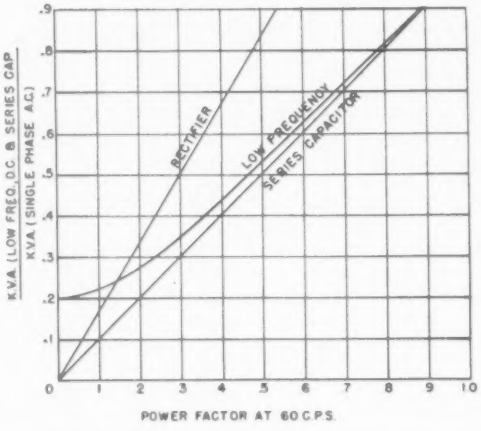
Experience has shown that the values given in Fig. 6 are correct; in practice, secondary voltages have been reduced anywhere from 50 to 30% of their previous value to perform the same welding operation.

Fig. 7 compares demand in the secondary circuit of a low-frequency machine to kva requirements of the 60-cycle machine. The ordinate represents the ratio of the low-frequency kva to the single-phase, 60-cycle kva. If an average power factor for the 60-cycle welding machine is taken as 40%, which is an approximate average, it can be seen that the low-frequency demand is approximately 43% of the 60-cycle value. The reduction is approximately the same for either a three-phase or a single-phase low-frequency machine.

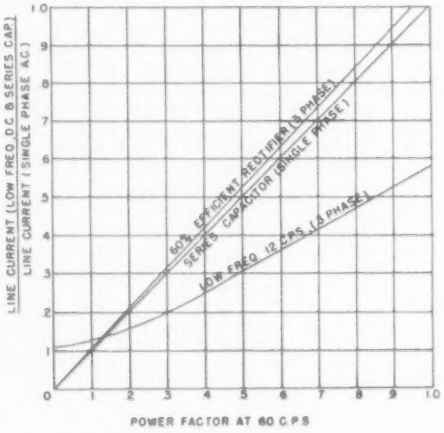
When kva are reduced, currents are likewise reduced as can be seen from Fig. 8. If the average machine having a power factor of 40% is built for operation on a low-frequency system, the current will be approximately 25% of the 60-cycle values. The values given in this



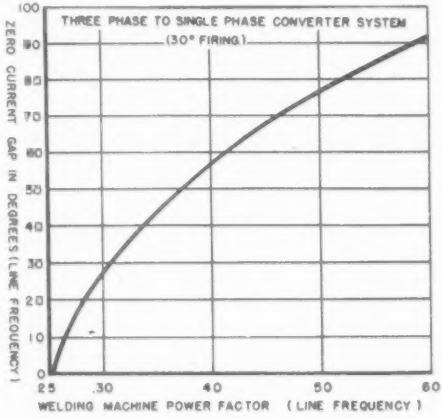
6—SECONDARY voltage ratio of a 60-cycle system to a low-frequency (12-cycle) converter



7—KVA DEMAND compared. For power factor of 40%, low-frequency demand is 43% of the 60-cycle



8—LINE CURRENTS compared. For 40% power factor, value of l-f current is 25% of 60-cycle



9—ZERO-CURRENT gap (vertical axis) is related to power factor as shown by the above curve

figure are not peak values but average rms values of line currents. The rms line currents are not exactly equal in a low-frequency system since the secondary current rises slowly and this rising current cannot be divided equally among the three lines. The result of an exact calculation of the line currents is shown in Fig. 10. Although the values given are expressed in terms of secondary rms current, they show the division of line currents in the three different lines. In this particular case—the 12 cycles per second—the division of line currents is approximately of the ratios of 0.88, 0.83 and 0.72. As the converter frequency increases, the line currents become more unbalanced; and as the frequency decreases, the line currents become more balanced. In spite of the divergence of the line currents, however, the average line current in a converter system is still about 25% of that in the line frequency system.

In a field such as this, developments move so rapidly that it is difficult to keep up to date. Therefore the preceding information must be taken as a guide rather than as a final solution. For example, a new type of circuit is now being built into frequency converters. The story of the development of this circuit is interesting:

Zero-Current Gaps

In electrical terms, there exists a "zero-current gap" between the individual half cycles of current in a pulsating current system. From a welding standpoint, it is desirable to keep this gap to a minimum. Especially is this true in aluminum welding since the aluminum has a chance to cool during the "off" period.

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6 Ways to Beat Your Mild Steel Welding Problems

"AP" (6010) For *all-position* welding with DC • Lots of penetration • High tensile and good ductility • Quick, easy slag removal • X-ray quality

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"AC-3" (6013) For use where *appearance* is important • Flat fillet • Easy slag removal • All position • Good physicals • AC or DC

"DH-2" (6020) For flat butt and horizontal fillet welds • America's fastest electrode • No spatter • Easy slag removal • X-ray quality • AC or DC

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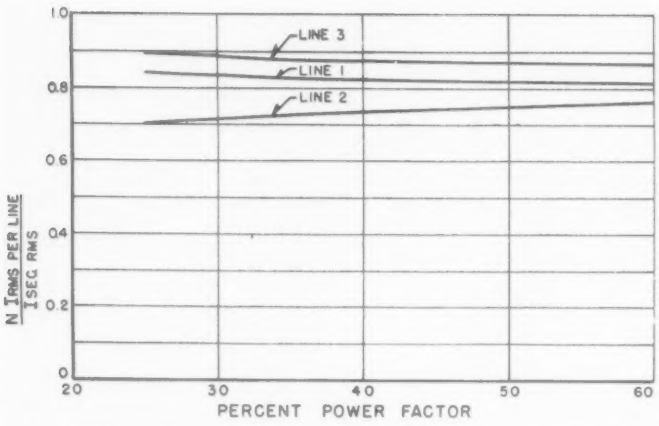


10—DISTRIBUTION of line currents in three-phase frequency converters

Cooling during the off period, in effect, makes the first cycle of welding current the only effective one. The following cycles do nothing more than heat around the weld nugget. For this reason, control designers try to keep the zero-current gap down to zero. Due to the inductance of the transformer, this gap is not controllable by the manufacturer of the converter.

Fig. 9 shows the relationship between the welding machine power factor and the zero-current gap. If the welding machine power factor is 30%, it can be seen that the gap between half cycles is 28 degrees. If the power factor of the machine is 25%, the gap is zero. This, of course, is an ideal situation for welding aluminum since the heat delivered to the weld is continuous and will not allow the weld nugget to solidify during the zero-current gap. However, the welding machine power factor is not controllable, and, consequently, on some aluminum jobs the power factor was lower than 25%. This meant that when the last pulse of current was being carried by one tube, another tube was trying to carry current in the other direction. Such an action produces, in effect, a short circuit on the primary of the welding transformer. Consequently, an attempt to bring the gap down to zero is an extremely critical operation, although desirable from a welding standpoint. Circuits have been recently invented for frequency converters that will eliminate shorting and will allow the zero-current gap to be lessened. In many cases a continuous alternating current can be made to flow in the secondary of the welding transformer.

In effect, these recently developed circuits force the last pulse of current to reduce in a manner which eliminates the gap. Not only does this have advantage from a welding standpoint, but it further balances line currents. In some cases the currents can be forced in such a manner as to develop almost perfectly balanced rms line currents. The division of line currents shown in Fig. 10 is no longer valid since all lines are now closer to the average.

The secondary effect of shortened gap means that the secondary voltage of the welding transformer can again be lowered a small amount since the power is delivered continuously to weld. Although no work has been done on calculating the values of secondary voltage with the newly developed circuits, the author feels that the secondary voltage will again be lowered by 10 to 15%. This, in effect, lowers the kva demand on the line and also the line current needed to produce a given secondary voltage.

Still another advantage of the new circuit is elimination of the possibility of shorts on the primary of the welding transformer. Many persons experienced in designing converter transformers are acquainted with the typical "banging" that exists when the welding machine has a low power factor. The control compensates for a bad power factor and eliminates the possibility of shorting the primary of the transformer.

Since many of the difficulties have been overcome by the recently developed circuits, application of three-phase and single-phase low-frequency systems is expected to proceed more rapidly. Not only have the problems of welder manufacture been made easier, but further advantages are given to the ultimate user.

DESERT PENSTOCK LINE

(Continued from page 37)

joints allowing longitudinal movement is of special interest. These were constructed of a 2¼ in. steel outer sleeve, a 2¼-in. nickel-clad steel inner sleeve and conventional packing glands. Specified minimum nickel cladding was 5% of the sleeve's thickness. Glands were packed with eight rings of 1¼-in. square lubricated flax and made watertight. The widest expansion joint was 7 ft. 10 in. and weighed 46 tons—one of the largest steel expansion joints ever constructed.

The problem of fabricating expansion joints was greatly complicated by the size and stiffness of the joints and by the specified tolerances of 1/16 to 1/8 in.—extreme accuracies for big-diameter joints.

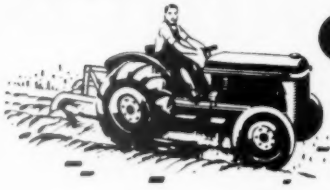
Expansion joints were fabricated and assembled in Southwest's Los Angeles shops, carefully match-marked, broken apart and trucked to the field welding station. Outer sleeves were shipped in three plates; inner sleeves and glands in two pieces. All seams were manually welded. Longitudinal seams of the inner and outer sleeves and packing glands were ground flush. As with the penstock sections, stiffeners and centering bars were fitted and welded.

Forty Tons of Electrodes

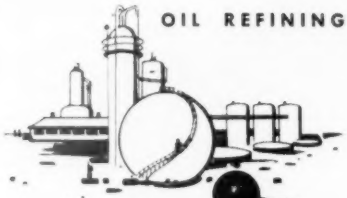
Forty tons of electrodes and automatic welding wire were used on the Davis dam penstock job. Desert temperatures often reached 120 F, and once soared to 130 F, but most of the weldors and fitters stayed on the job. So well did the men work that Southwest completed the contract in advance of the delivery date.

Besides the penstock sections proper, a total of 51 other sections —including expansion joints, bends and elbows—were fabricated and welded at the desert assembly line.

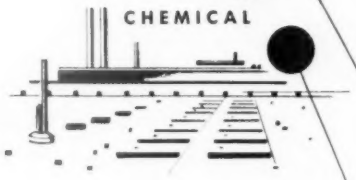
AGRICULTURE



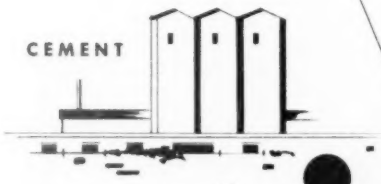
OIL REFINING



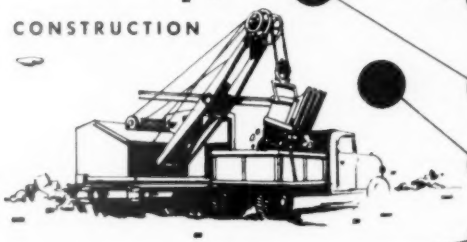
CHEMICAL



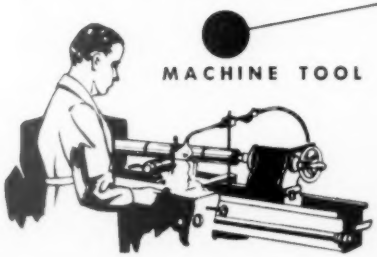
CEMENT



CONSTRUCTION



MACHINE TOOL



"Colmonoy" SERVES ALL "Industry"

* ● Machinery is used in almost all phases of industry. This machinery is constantly subject to wear—wear is costly in time as well as money. Whether this deterioration is from friction, abrasion, corrosion, impact or excessive heat, COLMONOY HARD FACING ALLOYS will increase the life of these machines 3 to 28 times. Below are listed a few typical examples of actual case histories.

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   Plow shares treated with **Colmonoy** sweat-on paste hold their edges and last up to 17 times longer.
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   Pump parts **spraywelded with Colmonoy No. 6** give 600% more service even when operating in Caustic or Sulphuric.
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   Valves, operating in even the most corrosive mineral acids, last 5 times longer when protected with **Colmonoy No. 5 rod.**
4. **Cement Industry . . .**
   Mill hammers faced with **Colmonoy No. 1** crush 300% more rock.
5. **Construction Companies . . .**
   Shovel teeth built up with **Colmonoy No. 1** reduces maintenance cost over 70%
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   Colmonoy center tip castings soldered on new or worn centers wear from 7 to 10 times longer.

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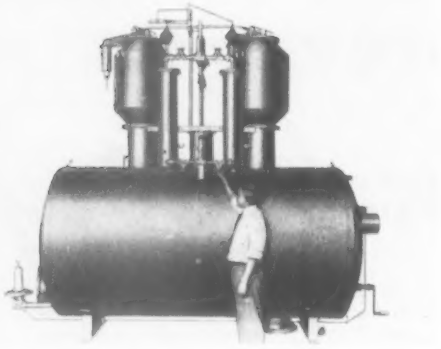
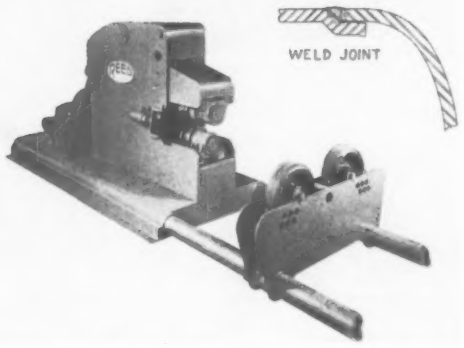


TWIN HOPPERS provide continuous flow of carbide to factory-size acetylene generator. It maintains line pressures up to 13 psi



OFFSETS on ends of cylindrical shells formed by new rolling machine. No back-up needed on resulting joint with tank head or end

New Generator Produces Continuous Acetylene Flow

NEW stationary-type acetylene generator supplies a continuous flow of acetylene for pipe line distribution. Only attention required is to refill hopper with calcium carbide when empty and meter required amount of water into tank. Both jobs can be done almost simultaneously.

Called the "A-Twin" because of the two hoppers on top of the tank, the new model uses 1/4 by 1/12 calcium carbide. When one hopper is empty the other goes into service automatically.

Safety features of the "A-Twin" include a dehydrator rubber throat at the base of each hopper that maintains a dry atmosphere around the carbide feed valve to prevent clogging. A flexing device wipes the splash protector and dehydrator tube clean each time the carbide hopper is refilled. An automatic water level control permits the correct amount of residue to be discharged each time the tank is filled with water.

A medium pressure generator, the "A-Twin" can be operated at any desired pressure up to 13 psi to force acetylene through long pipe lines without the use of compressors.

Five sizes of this generator will be manufactured in 500, 800, 1,200, 2,000 and 2,400 cu ft per hour capacities. Extra equipment will include a hopper loader that can be filled at floor level and hoisted by chain blocks into position over the hopper.

THE SIGHT FEED GENERATOR CO., West Alexandria, O.

* * *

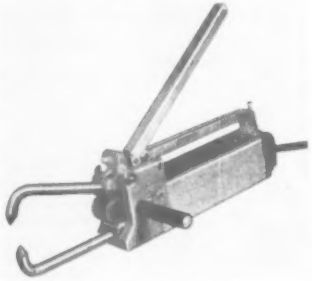
High Tensile Strength for Aluminum Electrode

WELD deposit of a new aluminum electrode has a tensile strength of 34,000 psi, its maker claims. Called "Eutectrode 2101," the electrode is said to weld with no smoke or troublesome fumes to shield the weld puddle.

Amperage for use with the new electrode can be as much as 30% lower than for conventional electrodes, says the manufacturer. This makes it applicable for reclaiming castings or repairing old ones. Available in 1/8 and 3/16 in. diameters.

EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York City 13.

* * *



Improved Portable Welder Packs Twice Old Capacity

REDESIGN and improvement of the power unit in the Miller portable spot welder raises its welding capacity to a combined thickness of 3/16 in. in mild steel. Designated Model LMSW-52, the new welder has a detachable handle for making certain welds easier.

Welding tongs for the Model LMSW and the older Model MSW are interchangeable but their tips are not and should not be used as such. Various shapes of tongs for various requirements are available for the new welder. A timer control speeds production work.

Welder must be used on 220 volt lines only. Its weight is 31 lb.

THE MILLER ELECTRIC MFG. CO., Appleton, Wis.

Forming Machine Makes Offset Joints for Welding

A NEW Reed offset-forming machine bends the ends of shell sections so that tank heads can be easily and rapidly fitted. The offset becomes the back-up for welding, eliminating need for back-up bar. More nearly round shells result from the new process, says the maker. In addition, mill scale and rust on the weld joint are removed.

Picture above shows the type weld joint possible with the new machine. The machine shown, Model M-4, handles steel ranging from 3/16 to 7/16 in. in thickness. Minimum diameter of shell is 24 in.; maximum diameter depends on rigidity of the shell and material handling equipment. Space needed by the forming roll is about 4 by 8 ft. Shipping weight is 5,000 lb.

THE REED ENGINEERING CO., 1003 West Fairview Ave., Carthage, Mo.

* * *

Small Air Grinders Clean Welds, Castings

TWO new "short type" air-powered grinders use 20,000 rpm speeds to clean welds, smooth castings, grind dies, etc. Model M-612 has a 1-in. spindle projection, threaded 3/8 in.-24 and weighs 3 lb 6 oz. It is 9 13/16 in. in overall length. Straight type grinding wheels and cone or plug shaped wheels are mounted on the spindle.

The smaller Model M-613 has a 7/16 in. spindle projection, weighs 3 lb 4 oz. and is 9 1/4 in. overall. Both models have a cast-in oil reservoir.

MASTER PNEUMATIC TOOL CO., Inc., Orwell, O.

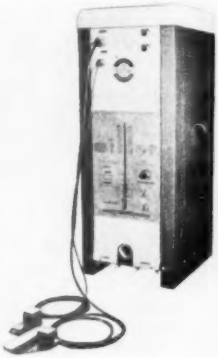
* * *

Change Electrode Name

"RAILENDER" is the new name for electrodes formerly designated "Railend" by Champion Rivet Co., Cleveland, O.

for welding

High-capacity acetylene generator and offset forming machine lead our May array of New Products. Handy foot-switch control for inert-arc welders and a helmet with periscope are also new



New Inert-Arc Welder Features Remote Control

NEW ALTERNATING current welder for inert-gas-shielded welding has a hydraulically operated remote amperage control. A reversible foot switch enables the operator to reduce heat quickly or slowly. This should speed up welding of pieces composed of both thin and thick sections.

Three amperage ranges, 10-200, 10-400 and 10-700 amps in either "A" or "B" models are available. The "A" models have two foot switches, one for power and high frequency and the other for amperage. The "B" models have only a single switch for controlling current. Gas and water are automatically controlled on the "A" models. Gas, water, power and high frequency are controlled automatically on the "B" models.

THE MILLER ELECTRIC MFG. CO., Appleton, Wis.

* * *

Norwegian Welding Flux Removes Aluminum Oxide

A NEW aluminum welding flux developed in Norway is said to efficiently remove oxide film prior to welding. Called "Lithal Super," it flows easily after melting to secure thorough penetration.

When melted with the oxide, the mixture has a lower specific weight than the melted base metal. No fumes are produced, it is claimed.

"Lithal Super" keeps well, either in its original powder state or mixed into a water paste. Small residue left after welding is readily soluble in water.

It may be used with rolled and cast aluminum as well as the following alloys: Al-Cu-Mg, Al-Cu, Al-Mg-Si, Al-Mg-Mn, Al-Si and Al-Mn.

AASMUND L. ANDERSEN, Colletsgate 43, Oslo, Norway.

* * *

Periscope on Welding Shield Helps Offset Welding

SPECIALIZED welding shield mounts a small periscope for seeing into offset or crowded weld joints. A true picture is transmitted to the weldor's eyes; no reversing is experienced as with individually placed mirrors.

A colored welding lens is placed inside the periscope frame for protection. It may be turned out of the way for inspection of the weld by pulling a trigger with the index finger of the holding hand. Both inside and outside openings of the shield are protected by a clear cover lens.

Construction of the shield is fibre; the periscope is of light metal. Length, including handle, is 18 in.

INDUSTRIAL PRODUCTS CO., 28-2 North Fourth St., Philadelphia 33.

* * *

Cast-Iron Electrode Deposits Machinable Welds

DESIGNED specifically for producing fully machinable welds in cast iron, the W-2075 arc welding electrode may be used in all positions. It is composed of pure nickel-core wire and an extruded black coating that is consumed in the arc.

Weld deposits are said to be color matching and offer resistance to cracking. Designed for operation at low currents, the new electrode minimizes brittle heat-affected zones. For use on either a-c or d-c, the 3/32-in. electrode operates efficiently at 50-70 amp. For the larger 3/16-in. diameter, 120-160 amp are used. All electrodes are 14 in. long.

GENERAL ELECTRIC CO., Schenectady 5, N. Y.

* * *

Welding Clamp Holds Plowshares, Steel Bars

PLOWSHARES, bars, sheets and other metal shapes are held rigidly for welding in the "Commando" adjustable welding clamp. Really a small positioner, the clamp can be easily moved to new positions as welding progresses.

The positioner has a heavy cast steel base with holes drilled for mounting on tables, benches, etc. Sliding bars on the tightening nuts give extra leverage for the secure fastening of all workpieces.

J. M. RAGLE Industries, 4029 Indiana, Kansas City, Mo.

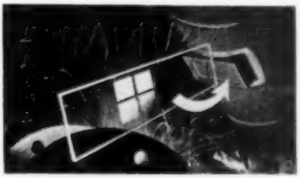
* * *

Triple-Purpose Flux Saves Brazing Time

TO SAVE time in brazing work, a new flux can be used three ways: (1) for general brazing (2) cast iron welding and (3) cast iron brazing. Called "York's 77" this flux deteriorates very slowly.

YORK ENGINEERING CO., 3349 West Ogden Ave., Chicago 23.

* * *



1,000-HOUR LIFE is claimed for a new plastic cover lens for welding helmets. Spatterproof and non-pitting, it minimizes eye strain and fatigue. It has high resistance to cracking. Thickness is 1/16 in. Made in standard widths. Flood Safety Products Co., 3035 West Lake St., Chicago 12

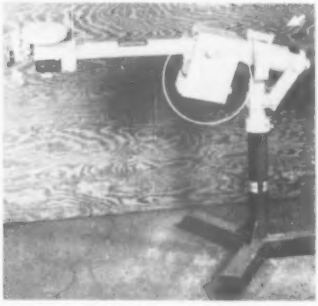
Welding Gas Mask for Hazardous Welding

WELDORS wearing the new "Pur-a-Weld" mask amidst hazardous gases or smoke have full vision. The mask may be used interchangeably with dust and fume canister or a compressed-air supply unit.

Lenses for the mask run in shades 4 to 12 for every type of working condition. Other features are easy fit and comfort, free-breathing, and replaceable welding hood.

ACME PROTECTION EQUIPMENT CO., 3037 West Lake St., Chicago 12.

* * *



Friction Brakes Added to Welding Positioner

IMPROVEMENTS in the Model 14C500 balanced welding positioner produced by Aronson include friction brakes and redesign of the balance adjustment. The work-table arm and the work arm now have brake bands actuated by knobs (arrows) for better control of the workpiece while welding.

Movement of the worm adjusting control (circle) to the bottom side allows larger-diameter workpieces to rotate clearly without obstruction.

Capacity of the Model 14C500 is 500 lb. A similar model, the 14C1000 will handle 1,000 lb.

ARONSON MACHINE CO., Arcade, N. Y.

Dry-Chemical Extinguishers Use Nitrogen Pressure

LARGE stationary fire-fighting apparatus for protecting refineries, railroad yards, chemical plants, tank farms, etc., consists of a centrally located tank containing dry-chemical extinguisher and nitrogen cylinders for pressurizing the tank. Piping runs underground from the tank to hose houses where 1-in. chemical hose is stored. Effective range from the hose nozzle is 35 ft. Large areas thus may be protected even when only one employee (such as a night watchman) is available for emergency fire duty.

The extinguisher tanks are built in 500, 1,000 and 2,000 lb capacities. Chemical hose for discharging the chemical comes in 50, 100 and 150 ft lengths. Specially designed nozzles for the hoses minimize the recoil attendant with the 450 lb per minute discharge rate.

ANSUL CHEMICAL CO., Marinette, Wis.

* * *

Ground for Turning Rolls Employs Tiny Magnets

IMPROVED version of a new ground for turning rolls includes a magnetic chain that maintains contact with the cylindrical workpiece. Magnetic influence of the chain is said to produce superior welds and eliminate cut-outs.

Installation of the Model No. 1200 ground is a simple matter; just connect the ground cable, place the device under the work and adjust the elevating screw until the chain makes contact with the work surface.

Adjustment range of the new ground is 11 in. up and down and capacity is any current up to 1,200 amp. Shipping weight is 60 lb.

THE MAGNETRODE CORP., 1708 Main St., Kansas City, Mo.

* * *

Device Reduces Voltage to Protect Weldors

SAFETY attachment protects weldors from shock when not welding by reducing the open circuit voltage to less than 15 volts one second after the arc is broken. Voltage is restored by a magnetic contactor when the electrode touches the workpiece again. The attachment can be used on any a-c welder including those with superimposed high-frequency current for arc stabilization.

E. M. F. ELECTRIC CO., PTY LTD., Melbourne, Australia.

Plate-Handling Clamps Have Tool-Steel Jaws

JAW bearing surfaces made of hardened tool steel are featured on a new line of handling clamps for steel plate. The bearing surface is a grooved replaceable insert in the body of the clamp.

Various size clamps handle plates in thicknesses ranging from ¼ to 6 in. thick and up to 12 tons in weight.

NEVER-SLIP SAFETY CLAMP DIVISION, KENSICO MFG. CO., Mt. Kisco, N. Y.

* * *

Large Shear Cuts Steel 1-in. thick 12 ft long

LARGEST "Steelweld" shear built to date has a shearing capacity of 12 ft of 1-in. steel plate. It utilizes a pivoted-blade cutting principle rather than slides or guides for the knife. The upper blade operates on two heavy pins secured to the side frames and travels in a circular path. Cutting rate is 25 strokes per minute.

THE CLEVELAND CRANE & ENGINEERING CO., Wickliffe, O.

* * *

NEW PRODUCT BRIEFS

New control device responds to a flow of cold water to open or close an electrical contact on resistance welders, hot water heaters, induction heaters, transformers, etc. It is called a flow interlock and measures 2½ by 3 by 7 in. GENERAL ELECTRIC Co., Schenectady 5, N. Y.

* * *

Electric current is transmitted from stationary to rotating members by a new high-capacity collector head. Efficiency is claimed higher than with carbon brushes because of less resistance. Some heads are rated at 10,000 amp continuous d-c. SCIAKY BROS., INC., 4915 West 67th St., Chicago 38.

* * *

Hydraulic bending machine for small tubings, bars, strip stock, angles, etc., provides precise control over radii, angles and multiple bends. Capacity is 1½ in. OD tubing of 16 gauge. O'NEIL-IRWIN MFG. Co., Lake City, Minn.

* * *

Electric scale control prevents scale from forming in water cooling systems. Chemicals in the water receive an electrical charge from the device which makes them repellent to tubing surfaces. AQUA ELECTRIC SCALE CONTROL, 2028 East 22nd St., Cleveland 15.

(*Continued on page 70*)

$125 and 7 weeks saved, thanks to NI-ROD repair of cast iron speed reducer

When a mishap all but destroyed a vital coil-vat speed reducer, maintenance men of the M & R Dietetic Laboratories were faced with a serious problem.

A new speed reducer cost 135 dollars and would take 8 weeks to be delivered. Repairing the unit would require only a week, but the damage was so extensive that success seemed doubtful. Yet, there was so much to be gained that they decided to take the gamble.

The shattered speed reducer was sent to M & R's welding shop, where . . . using Ni-Rod® electrodes . . . their welding technicians succeeded in assembling the broken pieces.

The cost of the repair, including labor, was only 10 dollars, and the time required was 1 week. *This represented a net saving of 125 dollars and 7 weeks down time. A highly profitable operation, indeed!*

Experiences such as this . . . of time and money saved in welding cast iron with Ni-Rod electrodes . . . are daily occurrences at thousands of welding shops throughout the nation. The reason for Ni-Rod's popularity with these experienced welders is *dependability*. With Ni-Rod electrodes you get quick, sound, machinable welds in all grades of cast iron . . . usually without preheating or postheating. Ni-Rod works well in all positions; can be used with either AC or DC current.

The best way to find out about Ni-Rod's many advantages is to try it. Order a package today and discover for yourself why *4 out of 5 shops* re-order Ni-Rod, once they have tried it.

Your nearest INCO distributor stocks Ni-Rod in 3/32", 1/8", 5/32", and 3/16" diameters.

Coil-vat speed reducer repaired with Ni-Rod at M & R Dietetic Laboratories, Columbus, Ohio.

For welds you've never been able to make before . . . in high-phosphorous irons; heavy sections—

NI-ROD "55"

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

PAGE *Welding* ELECTRODES

a NEW line of Page-Allegheny AC-DC Stainless Steel Electrodes

ANOTHER STEP FORWARD IN WELDING STAINLESS!

they're NEW

... ***BUT*** they've been "given the works" by many large fabricators of stainless steel equipment—on the job. And, from all reports, they're the most all 'round satisfactory electrodes PAGE ever developed for any kind of weld on any type of stainless steel. And PAGE has been making stainless steel electrodes since the early development of stainless.

Ask your Page distributor about these new, improved Stainless Steel Electrodes

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

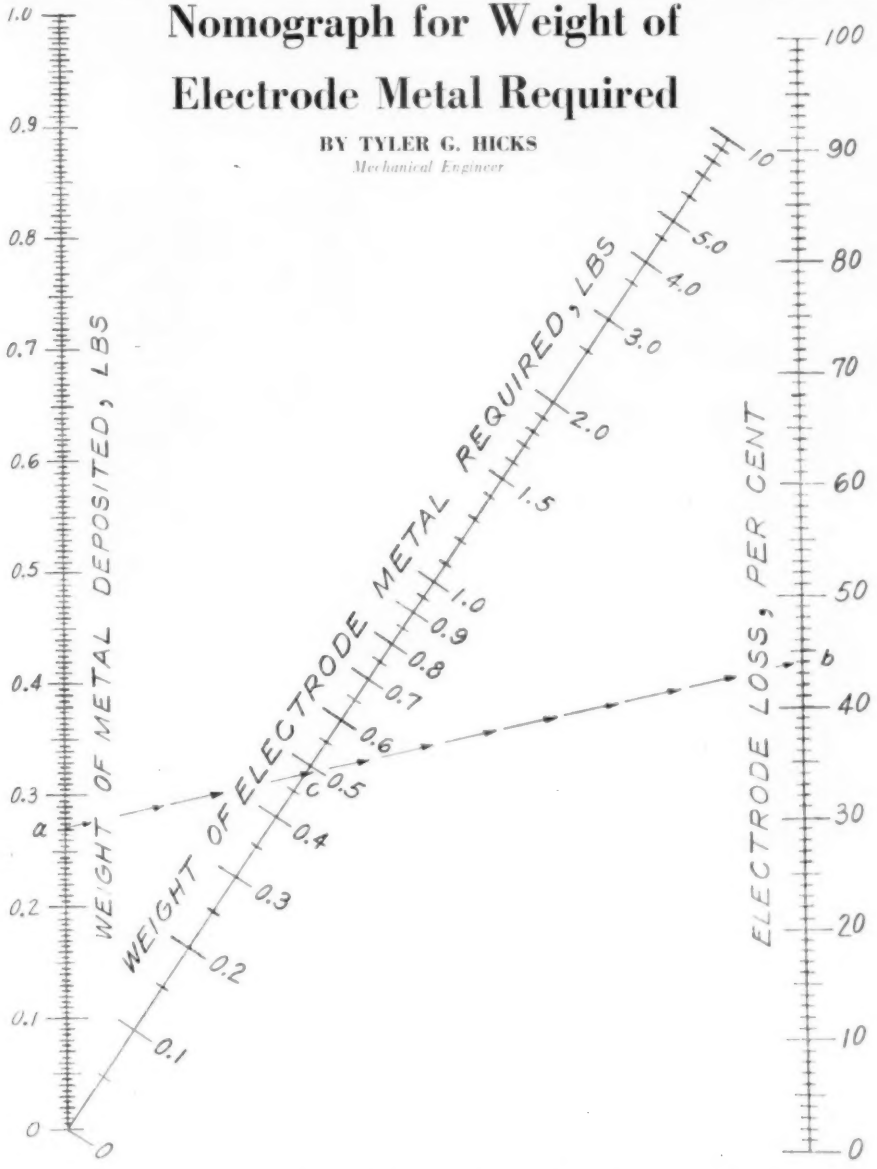
TRADE MARK

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Get in touch with your PAGE Distributor

Nomograph for Weight of Electrode Metal Required

BY TYLER G. HICKS
Mechanical Engineer



THE ACCOMPANYING chart gives quick estimates of the weight of electrode metal required for a given joint. It is based on the equation:

$$W = \frac{\text{weight of metal deposited, lb}}{1 - \text{electrode loss}}$$

where

W = electrode weight required, lb

Example: An angle joint welded with a $\frac{3}{8}$-in. coated electrode requires 0.272 lb of metal per foot of length. What weight of electrode is needed per foot if electrode loss is 44%?

Solution: Enter the chart on the left at 0.272 lb of metal deposited and draw a straight line *ab* across to 44% electrode loss. At the intersection *c* with the sloping scale, read 0.49 lb of electrode metal required.

In estimating the total electrode loss, include the scrap end, spatter and coating losses. If specific data are lacking, scrap end loss can be assumed as 17%; spatter loss at 13% with bare electrodes; spatter and coating loss together as 27% with coated electrodes.

The weight of metal deposited includes the volume required to fill the joint plus reinforcement.

Although the equation used in plotting this chart is available in most welding texts, one McGraw-Hill Book Co. volume in which it can be checked is *Standard Handbook for Electrical Engineers*, 1949, Section 18, par. 219.

VICTOR Weld
STAINLESS STEEL
ELECTRODES TYPE VW-1347
A.W.S. SPEC. CLASS E 347-15
Typical Deposit Analysis:
A.I.S.I. TYPE 347
Lime Coating
SIZE 32
TYPE VW-83
A.W.S. SPEC. CLASS
Standard Package: 25 lbs. net
SIZE 1/8
VICTOR EQUIPMENT CO. · CHICAGO · SAN FRANCISCO
FOR: Mild Steel—All Positions
Current: Straight, A-C
VW-20
FOR: High Quality Welds—All Positions. For Lap and Edge Welding. Deep Penetration.
Current: A-C or Reverse
TYPE VW-26
A.W.S. SPEC. CLASS E6011
Standard Package: 50 lbs. net
VW-25
E6013
3/32
FOR: Machinable Welds—Cast Iron. Cores Commercially Pure Eliminate Hard Zone.
Current: A-C or Reverse
TYPE VW-2075
A.W.S. SPEC. CLASS
Standard Package: 25 lbs. net
FOR: Deep Penetration and High Welding Speeds. Pressure Vessels and Structural Steel.
Current: Straight, D-C or A-C
TYPE VW-24
A.W.S. SPEC CLASS
Standard Package: 50 lbs. net
VICTOR EQUIPMENT CO. · CHICAGO
FOR: Fabrication of Armor Plate and High Tensile Steels of High Hardenability with A-C or D-C Low Hydrogen Covering All Positions.
Current: A-C or D-C Reverse Polarity.
VW-60
5/32
FOR: All Position Welding Copper Alloy 95% Copper Joining Mild Iron.
Current: D-C
Chemical Analysis:
98.95-8%
4.10-5%
.008-.010%
Standard Package: 25 lbs. net
VW-70
1"
FOR: General Purpose Welding of Mild Steel. Excellent Arc, High Ductility. Excellent Appearance.
Current: A-C or D-C Reverse Polarity.
VW-28
Standard Package: 50 lbs. net

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A Welding Engineer Reader Service

1 GAS WELDING OUTFITS—Victor Equipment Co., San Francisco 7. 8-page, two-color pocket-size folder, Form 312, shows five complete welding outfits. Each includes regulators, torch tips, a heating torch, midget regulators for small cylinders. All of the equipment is also listed and priced individually.

2 ACETYLENE GENERATOR—The Sight Feed Generator Co., West Alexandria, O. 8-page Bulletin A-250N gives complete description and illustration of the Models A and A-Twin stationary acetylene generators for factory installation. Half-sections and diagrams show every operating mechanism. Specifications for different sizes are included. For more details, see Page 44.

3 PORTABLE SPOT WELDER—Miller Electric Mfg. Co., Appleton, Wis. Single-sheet bulletin LMSWA describes the company's improved portable spot welder Model LMSW-52. Diagrams show various shape tongs available. Capacities, accessories and prices are included. For more information see Page 44.

4 METAL CLEANING—Oakite Products, Inc., New York City 6. 44-page booklet covers all phases of metal cleaning. It tells how to remove oils, greases, rusts, tarnish and scale, also suggests cleaning materials, equipment and procedures. Among subjects treated are: tank cleaning, bright dipping, electrocleaning of steel, prepaint cleaning and burnishing.

5 SHIELDED STUD WELDING—The Shielded Stud Welding Co., Los Angeles 13. 4-page brochure gives technical data on a new inert-gas-shielded process that is being used to weld studs on aluminum, stainless or copper base metals. It gives full details on how the new stud-welding process works.

6 INERT-ARC CATALOG—The Linde Air Products Co., New York City 17. 6-page folder F-7013 includes illustrations of five models of inert-arc torches for manual and mechanized operations. It also shows meters, valves, electrodes and other accessories. Text discusses the theory of the process, gives applications and advantages.

7 HEAT-TREAT CARRIERS—Strohecker Inc., Enon Valley, Pa. 8-page, two-color Booklet 3M 12-49 shows carriers to take work through heat-treating, pickling, enameling or other operations. It discusses the heat-resistant materials of which carrier are fabricated and gives information on construction and design.

8 WELDING HAMMERS—Bernard Welding Equipment Co., Chicago 19. Single-sheet bulletin MP4 describes the "Multi-Pic" hammer for efficiently cleaning fillet welds, butt welds, etc. Various handle types are illustrated and their prices given. Replacement brushes are also shown.

THE WELDING ENGINEER will request manufacturers to send readers the literature in which they are interested. Two post cards are printed here, each containing space for four items.

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9 ATTACHING CABLE LUGS—Tweco Products Co., Wichita 1, Kans. Single-sheet bulletin shows the Tweco "Lug-Set" block and punch for attaching copper lugs to welding cable without solder. It tells how to do it and why it works. Reverse side of sheet shows construction of the special copper lugs and gives dimensions of the three sizes.

10 WELDING POSITIONER—Hydraulic Products Co., Providence 1, R. I. 10-page booklet gives features of the "Dyna-Lift" air-operated lifter, which may be used as a welding positioner or as a general purpose shop elevator.

11 TRAILER COUPLERS—Acme Mfg. Co., Kansas City, Mo. Single-sheet bulletin describes eight models of couplers for attaching trailers. They may be mounted on house trailers, farm machinery, autos, etc.

12 LOW-TEMPERATURE WELDING—All-State Welding Alloys Co., Inc., White Plains, N. Y. 32-page pocket-size handbook and catalog of welding rods and fluxes gives application information, tables of characteristics and other hints about low-temperature welding and brazing.

13 INDUSTRIAL X-RAY—Eastman Kodak Co., Rochester 4, N. Y. 16-page catalog describes: (1) films for use with X-ray equipment, (2) processing chemicals, (3) intensifying screens, (4) exposure holders, (5) lamps, (6) viewers. Much useful information about industrial radiography is included.

14 ROTATING DRIVE—Victor Equipment Co., San Francisco 7. 4-page two-color folder No. R-101 tells about the Kinmont power unit for rotating piping or tank shells for downhand welding. Pamphlet discusses details of the "chain tong" drive and other operating features, gives specifications and lists replacement parts. Six pictures show applications.

15 INDUCTION HEATING—Electric-Arc, Inc., Newark 8, N. J. Single-sheet catalog page shows induction heaters and control units for the preheating and stress relieving of welded piping. Capacity, rating and other characteristics of heaters and regulators are tabulated.

16 ARC WELDER—Borm Mfg. Co., Elgin, Ill. Single-sheet bulletin describes the 150-amp Elgin Model WA-150 arc welder. Its operating features, rating and uses are given.

17 STUD WELDING—Graham Mfg. Corp., Ferndale 20, Mich. 4-page, two-color bulletin describes the Graham stud-welding process as well as the studs, machines and fixtures that do the job. Diagram and photos illustrate the principle and show various models of guns.

18 AUTOMATIC ELECTRODES—The Reid-Avery Co., Inc., Baltimore 22, Md. 8-page booklet describes "Raco" coated electrode wire for automatic welding without separate flux. Such auxiliary automatic welding equipment as adaptors, contacts and reels are also shown.

19 WELDING CHART—Eutectic Welding Alloys Corp., New York City 13. Large wall chart, 2 by 3 ft, lists more than 100 "EutecRods" and "EutecTrodes" for low-temperature welding. Under each rod is included the type of joint and metal for which it is suitable, bonding temperature, tensile strength, Brinell hardness, flame adjustment, etc. Very useful is a list of 300 production and maintenance applications.

20 SOLDERING GOLD—Handy & Harman, New York City 7. Bulletin 18 describes a new liquid flux for jewelers to use in the soldering of gold and silver.

21 WELDING CLAMPS — General Welding Co., Cleveland 3. Single-sheet, two-color bulletin shows five construction points of the General heavy-duty welding clamp. It gives the dimensions of various models and pictures of the clamps in service.

22 WELDED RINGS—Dresser Mfg. Division, Dresser Industries, Inc., Bradford, Pa. 8-page folder shows how rings are made for wheels, motor frames, exhaust manifolds, sleeves, cylinders, etc. It is done by bending flat bar stock, flash welding the joint and then expanding the ring (beyond the metal's elastic limit) to accurate size. The method can be used for stainless as well as mild steel.

23 ARC STABILIZER — Mid-States Equipment Corp., Chicago 16. Single-sheet bulletin describes the "Missing Link" high-frequency arc stabilizer, its operating principle and advantages. The stabilizer can be used to give smoother welding by the metal-arc, inert-arc and carbon-arc processes.

24 EXTINGUISHER CHECK CHART—Ansul Chemical Co., Marinette, Wis. Inspection chart for fire extinguishers has space for 26 inspections of 38 units. Column headings provide for such information as location of extinguisher, the purchase date, each refill or recharge date and the annual recharge date. Chart is printed on stiff paper for hanging on the wall.

25 FLASH WELDING—The American Welding and Mfg. Co., Warren, O. 20-page, two-color booklet CA-50-75 relates the advantages of flash-butt welding for such jobs as joining rings for jet engines, fabricating wheel bases, railroad car accessories, generator shells, engine housings, etc. It tells how the process is used on aluminum, steel, copper, high-alloy steel and cast iron.

26 HEAVY PRESSES—The Cleveland Crane & Engineering Co., Wickliffe, O. 8-page booklet, Form 2010-E, shows the "Steelweld" line of precision presses and describes all major operating parts. It diagrams special bed and ram design as well as standard dies and punches.

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NEW D-C WELDER SAVES $126 A YEAR IN POWER COSTS!

★ **NO-LOAD LOSS OF ONLY 500 WATTS...** compared to 2480-3600 watts on a conventional motor-generator welder.

★ **ENDS WELDER NOISE!** Lightweight, quiet selenium rectifier replaces old noisy motor generator.

★ **SIMPLICITY SLASHES OPERATING COSTS.** The new Westinghouse has only 3 basic elements ... transformer, reactor and rectifier. Saves motor and generator maintenance costs.

★ **SMOOTHER WELDING...** Less arc blow ... easier arc striking ... better weld quality.

FREE TRIAL!

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Westinghouse
D-C Welders

IAA 50TH MEETING

(Continued from page 35)

technical sales division, Air Reduction Sales Co., treasurer, and H. P. Reinhard, The Linde Air Products Co., secretary.

Film on Flame

One of the high spots of the technical sessions was the preview of the association's new film, "The Oxyacetylene Flame—Master of Metals."* T. C. Fetherston, chairman of the program, publicity and arrangements committee, introduced the presentation of the film by telling of the whys, wherefores and needs which inspired it. He said in part:

"This picture is a basic one, suitable for presentation to secondary school and college groups, to technical and non-technical meetings of various kinds, including local sections of engineering societies. It is about 20 minutes long and may be used effectively in an ordinary 45-minute class period, allowing time for an introduction before and discussion after the picture. It is designed so it may be used as an introduction to other pictures on the oxyacetylene welding and cutting processes and their applications in specific fields.

"The film has been produced in three versions, all alike except for their introductory titles. The basic film will be the version to be used by IAA and loaned to colleges, technical societies, etc. It will also be the version that we sell to the public school systems and other groups.

"The second version, the Bureau of Mines version, differs in that the main title and tailpiece will carry the Bureau of Mines seal. The title will say: 'The Bureau of Mines of the U. S. Department of Interior in coöperation with the IAA presents: "The Oxyacetylene Flame—Master of Metals."' We have furnished the Bureau of Mines with 100 prints of the picture to add to its nationwide distribution program for motion pictures.

"The third version, available for purchase at cost by our members, will carry the same introductory title as the first but can also include a statement such as: 'This film is exhibited through the coöperation of the John Brown Oxygen Co., Tulsa, Okla.'"

*Inquiries regarding the availability of this film should be directed to H. P. Reinhard, secretary, International Acetylene Association, 30 E. 42nd St., New York 17, N. Y.

Four Technical Sessions

Technical sessions were held on Monday afternoon, Tuesday morning and afternoon and Wednesday morning. Altogether, 11 technical papers were given.

Stephen G. Herrick, president of Herrick Iron Works, Oakland, Calif., presided over the opening technical session. There were two papers: "Research for the Benefit of Industry," by Dr. Morrough P. O'Brien, dean of engineering, University of California, Berkeley, and "Chemical Utilization of Acetylene," by Drs. R. H. Ewell and L. M. Richards, Stanford Research Institute, Palo Alto, Calif. Many new uses are being found for acetylene, including the making of aspirin.

The second-day sessions might well have been called undergraduate day. Selected engineering students were guests of IAA at the technical sessions, for luncheon and at a special showing of the new IAA movie. These young visitors came from Stanford, from California, from Santa Clara and College of the Pacific and also from junior colleges and trade schools in the area.

Farms to Pipe Lines

K. V. King, Standard Oil Co. of Calif., San Francisco, and R. L. Asquith, Kaiser Steel Co., Oakland, acted as co-chairmen at the Tuesday morning technical session. R. C. Wiley, instructor in the welding department, California State Polytechnic College, San Luis Obispo, talked on oxyacetylene welding in agricultural and industrial college training. Among other things, he told how they converted an old 110-kv medical-type X-ray machine into a practical means of checking the welding quality of students' work in materials up to 3/16 in. thick. The speaker found it difficult to separate arc and gas welding—this was one of the rare occasions when arc and resistance welding were discussed at an IAA meeting.

Talking on the construction and maintenance of pipe lines, R. D. Smith, assistant engineer, Pacific Gas and Electric Co., San Francisco, gave an extremely interesting historical background of the use of natural and manufactured gas. He wove into his talk the story of pipe lines, leading up to the 506-mile, 34-in. welded pipe line that P G & E is now running into the Bay area.

Last on the Tuesday morning program was a paper by Floyd H. Matthews, Boeing-Airplane Co., Seattle, on the use of pressurized gases in the aircraft industry.

Steel and Stresses

Morehead Medalist James Banash was chairman of the Tuesday afternoon sessions. Charles I. Orr, assistant to chief engineer, Consolidated Western Steel Corp., Los Angeles, discussed applications and uses of oxyacetylene processes in the steel fabricating industry. Consolidated Western is a United States Steel Corp. subsidiary operating principally in the northwestern, western and southwestern states, with plants in Los Angeles, San Francisco, Berkeley, Fresno and Bakersfield, Calif., and in Phoenix, Ariz., and Orange, Tex. The company's attention has recently been centered on the production of high-pressure expanded steel pipe. Current production is more than 200 miles per month of 30 to 36 in. pipe, manufactured on a highly mechanized production line. The formed pipe is preheated with oxygen and natural gas before it enters the automatic welders.

How the oxyacetylene process is used to reduce stresses was the subject of a research report prepared by Harry E. Kennedy, research associate of the University of California. In his absence, the paper was read by Prof. Earl C. Parker, also of the U of C. An interesting point was the claim that welding stresses of 40,000-45,000 psi may be reduced to negligible values by running oxyacetylene torches on either side of the weld at such a speed that the plate metal is raised to 350 F. The heated area should be 6 in. wide. The operation is accomplished at about 18 ipm. Greater efficiency in stretching the weld metal and avoiding distortion results by cooling the plates by a water spray after the heating.

Dr. Fennimore Davis gave a paper on safe practices in the use of gases and gas mixtures. This was something new to IAA members, for the gases concerned were anesthetics in-

stead of welding and cutting gases. Dr. Davis, it may now be mentioned, is chief anesthetist of Peralta General Hospital, Oakland. He gave some interesting demonstrations.

Bronze and Brazing

Ralph M. Hoffman, president, Link-Belt Co., Pacific Div., San Francisco, was chairman of the final technical session on Wednesday morning. Clinton E. Swift, sales engineer, American Brass Co., Waterbury, Conn., gave the first paper on "Gas Welding with Bronze in Production." Since Mr. Swift's excellent discussion is available in The Welding Engineer (April, 1950, page 36), no further mention of it need be made here.

How modern industrial and residential buildings are improved by the art of silver brazing was revealed by John B. Ross, Handy and Harman, Los Angeles. Low-temperature silver-brazing alloys and torch equipment join water, gas and fuel lines, of both copper and steel, including refrigeration and air-conditioning piping.

The final technical paper, on the subject of flame-hardening, was delivered by Edward Green, chief metallurgist of the Axelson Co., Los Angeles.

Business Meeting

The year's activities of IAA were well covered in the combined report of the secretary and consulting engineer, presented by J. I. Banash, at the "members only" business meeting on Wednesday afternoon. Secretary H. F. Reinhard read the report of E. V. David, treasurer. The report of the oxyacetylene committee (prepared by A. M. Setapen, chairman) was given by J. B. Ross. C. McL. Pitts, The People's Gas Supply Co., Ltd., Ottawa, gave the report of the resolutions committee, of which he was chairman.

Final business before the 50th annual meeting was the election and installation of new officers. In addition to those already named, three directors were elected for three-year terms. These are: Retiring President A. J. Fausek, Modern Engineering Co., St. Louis; C. F. Smith, Sight Feed Generator Co., West Alexandria, O., and André Lot, Canadian Liquid Air Co., Ltd., Montreal.

Extensive repairs made quickly with
BRIDGEPORT'S No. 192 LOW FUMING BRONZE ROD

Frames for hydraulic pumps operating under 1200 pounds per square inch pressure are not carried in the spare-part storeroom. Nor is there time to wait for a new one to come from the factory when failure occurs.

A few hours after the maintenance crew had removed this cast iron pump frame, the broken and badly worn areas had been braze welded and ready for reinstallation. Bridgeport's No. 192 Low Fuming Bronze Rod was used.

With this type of bronze welding rod, long preheating and cooling periods are eliminated as the parent metal need only be heated to a cherry red before tinning begins. These alloys flow freely and the repaired sections are usually stronger than the original casting. Often repairs can be made without removal of the broken section from the equipment.

Write for Bridgeport's "Bronze Welding Alloys" booklet for more information about this modern, economical repair and production tool.

BRIDGEPORT BRASS COMPANY
Bridgeport 2, Conn. Established 1865
Mills at Bridgeport, Conn., and Indianapolis, Ind.
In Canada: Noranda Copper and Brass Limited, Montreal

Bronze Welding Rod A PRODUCT OF
BRIDGEPORT BRASS

HOOKED together with log chains, these 8-ft welded steel balls will roll down Montana hillsides to clear brush and small trees. Built to clear the 25,000 acre reservoir area above the Hungry Horse, Montana, dam, the 4½-ton balls were designed by Wixson and Crowe, Inc., and J. H. Trisdale, Redding, Calif., clearing contractors. Plates are ¾ in.

"RAMBLER" 5-passenger custom convertible is newest Nash model. It has a one-piece welded frame-and-body. Car has 100-in wheelbase and 82 hp, 6-cylinder engine. It is claimed to make 30 miles per gallon of gas. Nylon-coated steel cables draw the fabric top on the heavy steel rails over the side windows. Tread is nearly standard width

NEWS OF WELDING AND WELDING MEN

Omaha Welding Confab Attracts 750 Guests

DESPITE bad weather, more than 750 engineers, weldors, customers and maintenance men attended the Omaha Welding Confab at Omaha, Nebr., March 28-30. Sponsored by the Omaha Welding Company, the Confab is an annual affair attracting visitors from nine states over the Midwest.

Fine displays of welding equipment in 32 booths set up around the company sales room drew many comments. There were also a number of actual welding demonstrations where customers were given the opportunity to learn by seeing. Hard facing, low-temperature welding, white metal welding and other processes were shown at intervals during the three day show.

Welding movies and lectures on welding subjects were presented during the afternoons by factory representatives. Visitors agreed that the conference was informative and interesting in every way. Some visitors traveled as far as 700 miles to come to the show.

* * *

A. O. Smith Houston Plant To Produce Pipe in August

THE $5,000,000 Houston pipe mill of A. O. Smith Corporation of Texas is being rushed to completion and will go into production about August 1, according to company officials. Work on the plant goes forward 24 hours a day under the direction of The Austin Co., of Houston and Cleveland.

The plant has a heavy backlog of orders and will begin operation on a two-shift basis, employing more than 400 workers. One order is for 1,000 miles of 30-in pipe to carry natural gas from near Houston to Chicago. Output of the mill will be 35,000 tons per month or approximately 129 miles of pipe.

American Welding Wins Second Safety Award

AMERICAN Welding & Mfg. Co., Warren, O., recently received its second "Distinguished Service to Safety" award from the National Safety Council. Only 99 other companies have ever received a second award.

The hand-decorated scroll announcing the award was presented to William J. Sampson, Jr., president. The National Safety "S" Flag with Star was received by Leo Dunlap, general foreman and George Fuchilla, president of C. I. O. Local 1574, representing the workers of American Welding.

* * *

Farm Uses of Aluminum to be Explored

REYNOLDS Farm Institute has been formed by the Reynolds Metals Co., Louisville, Ky., to find more effective uses of aluminum in agriculture. The institute plans to explore every possible use of aluminum, such as roofing and siding, machinery, bins, structural members, etc.

The latest technical information on farm uses of aluminum has been compiled into a booklet, "Aluminum for Farm Structures," being distributed to county agents and vocational agricultural teachers. Compilation was with the cooperation of Department of Agriculture officials, the Federal Security Agency and professors at the University of Maryland and Cornell University.

To get a copy of the booklet, write to Reynolds Farm Institute; Box 1800, Louisville, Ky.

* * *

New Classification System for Metallurgical Field

A NEW way of classifying metallurgical literature has been developed by the American Society for Metals in cooperation with the Special Libraries Association. It uses a special punch-card system and provides for as many as 181,000 different index headings.

The punch-card method adopted is a hand-operated system requiring no elaborate or expensive equipment. Plans are under way for publishing the entire classification in book form.

* * *

Peters of Canada Changes Name to Airco

AIR REDUCTION CANADA LIMITED is the new name of the former G. D. Peters & Co., of Canada, Ltd. The company is and was a Canadian subsidiary of Air Reduction Co., Inc., New York City. Management remains in the hands of Hugh Chambers, who has been in charge of the Canadian operation for 30 years.

* * *

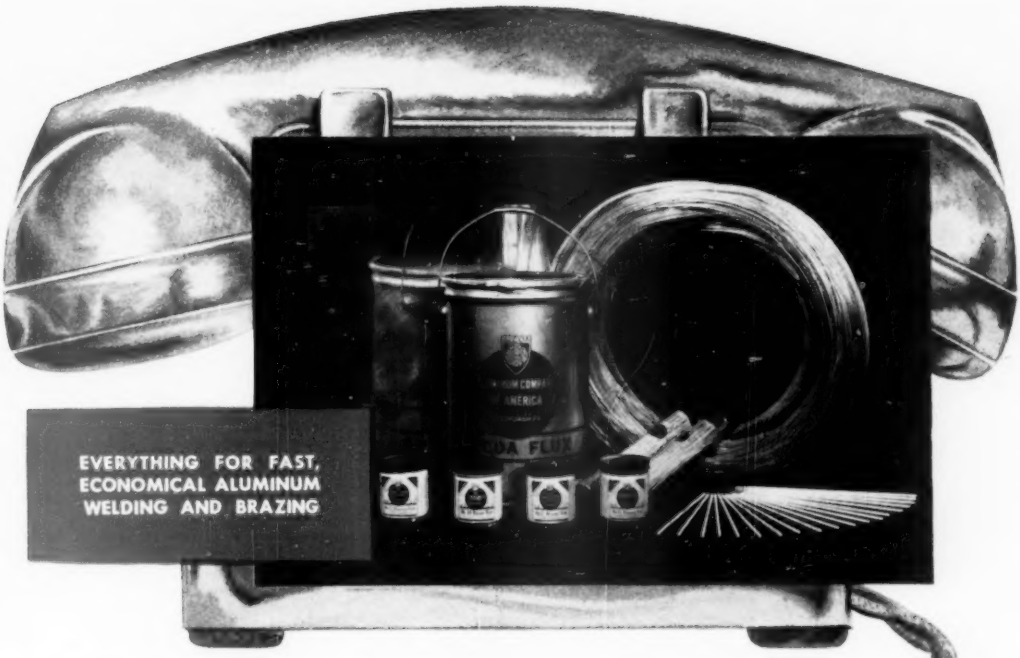
New Company Specializes in Inert-Gas Stud Welding

THE SHIELDED STUD WELDING CO., Los Angeles 13, has been organized to commercialize the process of inert-gas stud welding. Aluminum, copper, stainless steel and other metals are consistently end-welded with the inert-gas shield around the arc, according to an official of the company, Edward Dash. The company will supply equipment and studs to its customers.

* * *

Correction

THE EDITORS regret that two errors appeared in THE WELDING ENGINEER's Data Sheet No. 114 (March issue) which should be corrected. U. S. Standard Plate gage for gage No. 12 should read .1046 rather than 10.46. American Wire gage for No. 15 gage wire should read .0571 instead of .1571.



COMPLETE SUPPLIES FOR WELDING AND BRAZING ALUMINUM

Near as your phone!

In the listing at right, you'll find an Alcoa Distributor practically in your own back yard. He's a good man to know . . . for he carries the world's best stock of flux, rod, electrodes, solder, brazing sheet and wire. Results are predictable with Alcoa supplies because they're made by the men who know the metal best.

If there is no Alcoa Distributor near you, write ALUMINUM COMPANY OF AMERICA, 1943E Gulf Building, Pittsburgh 19, Penna.

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FLUX • SOLDER
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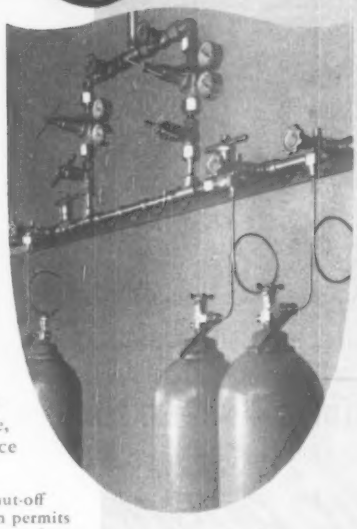
• Whitehead Metal Products Co., Inc.
Toledo, Ohio
• Williams & Company, Inc.
Tulsa, Oklahoma
• Metal Goods Corporation

REGO



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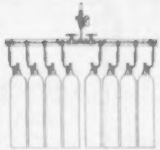
Rugged construction and precision control equipment give RegO manifolds long life, safe, dependable performance and low maintenance.

Continuous Operation . . . Shut-off valve at each cylinder station permits removal of any cylinder without shutting down entire side of manifold. Master valves control each bank of cylinders.

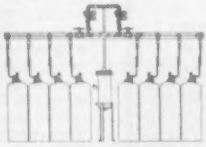
Unit Construction . . . Header consists of steel I-beam, extra heavy brass pipe and fittings, cylinder stations and master shut-off valves . . . *with all permanent connections silver brazed.*

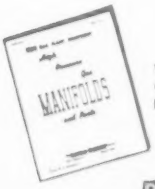
Precision Regulation . . . Uniform delivery pressure is assured by dual large capacity two-stage RegOlators.

Listed by Underwriters' Laboratories, Inc. and Factory Mutual.



Typical Single Regulator Wall-Type Oxygen Manifold



Typical Dual Regulator Floor-Type Acetylene Manifold

Write for 24-page catalog giving complete specifications.

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OXYGEN
ACETYLENE
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and other high pressure gases

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The BASTIAN-BLESSING Company
4201 West Peterson Ave. Chicago 30, Illinois

Canadian Welding Society Builds to Seven Chapters

THOUGH a young organization, the Canadian Welding Society now operates seven active chapters. Toronto, Hamilton, Montreal, Kitchener-Waterloo, the Niagara Peninsula, Winnipeg and Vancouver are the respective chapter meeting places.

Plans for 1950-51 expansion include an additional three or four chapters to be activated.

A national council governs the Canadian Welding Society. Members of the council consists of two past presidents, the incumbent president, two vice-presidents, treasurer and three elected trustees from each chapter. An executive secretary completes the council.

Present members of the council are: past presidents, J. J. Kelly, Lincoln Electric Company of Canada, president in 1949 and previously president of the Hamilton chapter and Gordon Cape, welding engineer, Dominion Bridge Co., Lachine, Que., president in 1948 and previously president of the Montreal chapter; president, R. A. Dunn, general sales manager, Canadian Liquid Air Co., Ltd., Montreal; vice-presidents, F. E. Benson, owner of Benson Gas & Equipment Sales, Niagara Falls, Ont., and E. G. Webb, associate professor in farm machinery, department of agricultural engineering, Ontario Agricultural College; treasurer, W. B. Lawrence, sales engineer, George Rumble Co., Toronto, and executive secretary, W. T. Cherry, Toronto.

Trustees from the seven chapters include: C. Eldridge, Canadian Kellogg Co., and G. J. Foster, Canadian Welding Bureau, Toronto chapter; J. Ritchie Walker, Steel Company of Canada and M. S. Mark, Mark's Welding Service, Hamilton chapter; Allan Clarke, Ontario Paper Co., Thorold, Alan Scott, Standard Steel Construction Co., Port Robinson, and J. W. Large, Provincial Engineering, Ltd., Niagara Falls, Niagara chapter; A. E. Ellis, Babcock-Wilcox & Goldie-McCulloch, Galt, A. A. Vertch, Waterloo Spring Co., Waterloo and K. W. Lamburner, Beatty Bros., Ltd., Fergus, Kitchener chapter; J. Royer, Welding & Supplies Co., H. Chatfield, Canadian Pacific Railroad, and G. E. Anderson, Air Reduction Sales Ltd., Montreal chapter; C. Paulley, Canadian National Railways and F. Wesley, Dominion Bridge Co., Winnipeg chapter and J. H. McNaughton, Dominion Bridge Co., Vancouver chapter.

* * *

Safety Directory Lists All Safety Devices

NEW *Best's Safety Directory for 1950-51* covers the entire field of safety, fire protection and control, hygiene, first-aid and sanitation. It is said to combine the features of a safety manual, directory, index, encyclopedia and catalog into one illustrated 511-page volume. A special indexing and subject-grouping system aids the reader to find products about which he has little information. Single copy price of the book is $5. It may be obtained from the Alfred M. Best Co., 75 Fulton St., New York City 7 or that firm's branch offices.

What's the right X-Ray film?

Product:
Pressure vessel
Material:
Cold rolled steel,
1-1/4 inches thick
Equipment:
200-kv x-ray unit

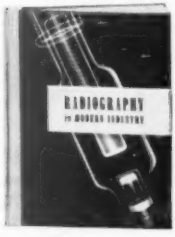
Remarks: RUSH

ANSWER:

KODAK INDUSTRIAL X-RAY FILM, TYPE K

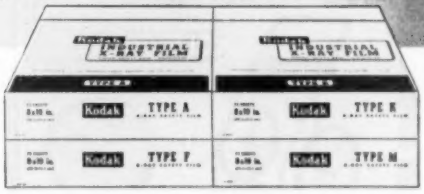
The wall of the tank was thick—the kilovoltage available was low. And the customer was impatient for delivery. So the radiographer did this job with Kodak Industrial X-ray Film, Type K.

This film, in contact with lead foil screens, has sufficiently high speed to allow reasonable exposure with equipment of moderate power. The good definition so obtained is added assurance that significant weld irregularities will not be missed.



RADIOGRAPHY IN MODERN INDUSTRY

A wealth of invaluable data on radiographic principles, practice, and technics. Profusely illustrated with photographs, colorful drawings, diagrams, and charts. Get your copy from your local x-ray dealer—price $3.00.



A TYPE OF FILM FOR EVERY PROBLEM

To provide the recording medium best suited to any combination of radiographic factors, Kodak produces four types of industrial x-ray film. They furnish the means to check welds efficiently and thus extend the use of the welding process.

Type K has medium contrast with high speed. For gamma ray and x-ray work where highest possible speed is needed at available kilovoltage without calcium tungstate screens.

Type F provides the highest available speed and contrast when exposed with calcium tungstate intensifying screens. Has wide latitude with either x-rays or gamma rays, exposed directly or with lead screens.

Type M provides maximum radiographic sensitivity, high contrast, and exceptional detail under direct exposure or with lead foil screens. It has extra fine grain and the speed is adequate for examination of light alloys at moderate kilovoltage and for much million-volt radiography.

Type A offers high contrast with about three times the speed of Type M, but with slightly more graininess. Used direct or with lead foil screens for study of light alloys at low voltages, and of heavy steel parts at 1000 kv.

EASTMAN KODAK COMPANY
X-ray Division · Rochester 4, N. Y.

"Kodak" is a trade-mark

Radiography...

another important function of photography

Kodak

made to SAVE MINUTES
made to SAVE MONEY
on every welding and cutting job!
for the best results at the lowest cost
BEST BUY BURDOX

Equipping the men in your welding-cutting departments with the correct tools and accessories is the quickest way for you to save time and cut costs. BURDOX products are made by men with years of practical experience in welding and cutting — that's why they reduce lost time to a minimum and produce better results. Get the best in welding, cutting and safety equipment without paying premium prices by using BURDOX all the time. The products illustrated below are only a few of the hundreds in the BURDOX line that offer you outstanding value. Make your own comparison by writing for Free BURDOX Catalog today!

CYLINDER TRUCKS DELUXE MODEL— The greatest cylinder truck value you've ever seen! Streamlined one-piece safety handle. Streamlined tool tray and rack. Bicycle type wheels with solid rubber tires. All welded construction. Chain holds cylinders securely.

GAUGES— Standard 2½" all brass beaded gauge with polished finished case. These pressure gauges are the result of broad experience in the oxy-acetylene welding and cutting process. They are carefully designed and manufactured . . . are unusually rugged and accurate.

CYLINDER CONNECTIONS— All brass, made to close tolerances. Guaranteed against mechanical defects. Finest made, yet cost no more.

EYEGARD GOGGLES— The best goggle value on the market! Super-light, impact resisting plastic and exclusive 10-way ventilation. Cool and sweat-free . . . always!

EXTRA-FLEX CABLE— Extra-flexible, extra-resistance to abrasion, oil and water because of special construction. Millions of feet sold because of performance and price.

TRIP-L-ITE FLINT LIGHTERS— Lasts three times as long as ordinary lighters. Produces a hot, fat spark every time. Works easy, insures instantaneous lighting.

THE BURDOX LINE INCLUDES:

WELDING AND CUTTING EQUIPMENT AND MACHINES • SOLDERING AND BRAZING OUTFITS • INDUSTRIAL GASES • REGULATORS AND GAUGES • HOSE AND CABLE • ACETYLENE GENERATORS • GOGGLES AND HELMETS • LENSES AND FACE SHIELDS • ROD AND FLUXES • CLYINDER TRUCKS

THE BURDETT OXYGEN COMPANY
3302 LAKESIDE AVENUE GENERAL ELECTRIC CLEVELAND 14, OHIO
Arc-welding Distributor
AKRON • MANSFIELD • CINCINNATI

Plastic Denture Used To Mount Metal Specimens

In studying the properties of metals, it is often necessary to embed a small metallic specimen within a larger piece of material in order that it may be conveniently held for polishing and microscopic observation. Several methods are now in use for mounting in bakelite, lucite or solids formed by the setting of resinous powders. In all of these procedures, the specimen must be heated to a high temperature under pressure, which often causes recrystallization and change in the structure of the metal. Moreover, rather expensive equipment is required.

A new method developed at the National Bureau of Standards, Washington, D. C., is said to permit the mounting to be done in 15 to 30 minutes. It is done at room temperature and without any other equipment than an inexpensive mold and a clamp or vise.

The new method, the brain child of the bureau's Denton L. Smith, employs a denture material of modified acrylic resin as the mounting. This material consists of a polymer and monomer which when mixed in the proper proportion will polymerize (set) under pressure at room temperature.

A brass mold is used, consisting of a hollow cylinder which fits into a depression in an anvil. The cylinder contains a movable piston. A quantity of the unpolymerized resin containing the specimen to be mounted is placed in the cylinder and pressure is applied between anvil and piston during polymerization by means of a bench press or vise operating in a vertical direction.

As it solidifies, the unpolymerized resin will bond to a piece of the solid resin placed in intimate contact with it in the mold. The specimen to be mounted is placed in a small quantity of unpolymerized resin beneath a previously cured blank in the mold. The mold is then closed and pressure is applied. When the reaction is complete, the blank and the resin containing the embedded specimen are tightly joined together.

* * *

Photo courtesy Robert Appleton

TALKING over photomicrographs of weld specimens are Miss Lois Butcher, 1950 "Poly Royal" Queen of California State Polytechnic College, San Luis Obispo, Calif. and Charles Meinhart of the college welding lab

AO Duraweld Coverglas GOGGLE

Here's THE Welder's Goggle

WITH **INDIVIDUALLY MOLDED EYECUPS FOR PROTECTION AND COMFORT • ADJUSTABLE METAL BRIDGE FOR STRENGTH AND UTILITY**

323R with adjustable metal bridge

323B
with rigid bar bridge

Gas welders, burners, cutters, brazers and furnace men like this goggle for wear over prescription safety goggles and personal glasses. Its hardened absorptive lenses, light weight and ventilation give comfortable protection against light radiations, glare, scale and flying sparks. Your nearest AO Safety Products Representative can supply you.

QUICK FACTS

LENSES—Noviweld shades 3, 4, 5, 6 or 8 or Noviweld-Didymium 3, 4, 5 or 6. Easily replaceable cover lenses protect filter lenses from scratching, pitting.

VENTILATED SIDE SHIELDS—Draft is indirect—bars rays, sparks and metal splashes from eye area while reducing lens-fogging.

EYECUPS—Opaque, individual—fit over practically all personal glasses.

BRIDGE—Available with rigid, adjustable, metal bridge (AO 323R) or with rigid bar bridge (AO 323B).

HEADBAND—Easily adjustable of one-piece rubber.

RUBBER CUSHIONS—May be had at slight extra cost.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities

Aircomatic Welding cuts production time 80% ... eliminates distortion

CONSOLIDATED WELDING AND ENGINEERING COMPANY, Chicago, Illinois, faced a serious problem in the welding of aluminum air separators. The methods considered couldn't handle the variety of thicknesses involved economically. Furthermore, they were slow and cumbersome, and raised many distortion problems.

J. E. Szymczak, Airco Technical Sales Representative, was called in. He suggested using the Aircomatic Process with Airco 1/16" 43s wire for the filler.

Major production and cost problems were solved immediately. For example, to weld two complete separator assemblies, including all the baffles, required only 180 man hours—about one-fifth the time of other methods considered . . . a tremendous time and money saving advantage.

Further, Aircomatic, with its high specific rate of energy input, and great welding speed, confined the heating effects to the narrow weld-zone . . . thus, completely eliminating the problem of distortion. Consolidated officials were delighted with these results, and placed the Aircomatic in operation at once.

Perhaps this unique welding technique can help you solve an important fabrication problem — so write your nearby Airco Office for Technical Sales assistance or for a copy of Aircomatic Welding Bulletin ADC-661.

AIRCO **AIR REDUCTION**

Offices in Principal Cities

TECHNICAL SALES SERVICE—ANOTHER AIRCO PLUS-VALUE FOR CUSTOMERS

Underground Piping Corrosion Information Collected

RESULTS of long-term tests on the resistance to underground corrosion of ferrous and non-ferrous piping are being studied by the Bureau of Standards. I. A. Denison and M. Romanoff of the bureau are analyzing the test results. Tests were made on about 3,000 specimens of pipe materials exposed to soil corrosion for periods up to 14 years. Specimens were buried at 15 test sites widely separated throughout the United States.

Long-term field investigations of piping corrosion began in 1922. Little was known then about the useful life to be expected of piping for transmission, distribution and storage of water, gas and liquid fuels. Results of this early study showed that corrosion of ordinary iron and steel in soils is much more general than supposed.

In 1932 the Bureau began a second long-term field investigation of the problem. With the active cooperation of manufacturers, pipeline operators and local water and gas companies, a number of weighed specimens of each selected ferrous and non-ferrous materials were buried at the test sites. Removal of two specimens of each kind was made after five successively longer periods of exposure ranging from 2 to 14 years.

Tests show that copper and its alloys with silicon, zinc and nickel are highly resistant to corrosion in soils which are very corrosive to ordinary iron and steel. Copper alloys differ widely in corrosion resistance, however, depending on soil chemicals. Soils high in sulphides corrode copper at an appreciable rate, but low-copper brasses are quite resistant.

"Dezincification" attacks low-copper brasses. This is a type of corrosion characterized by the conversion of small areas into spongy copper having little strength. It can be prevented by addition to the brass alloy of a small amount of arsenic.

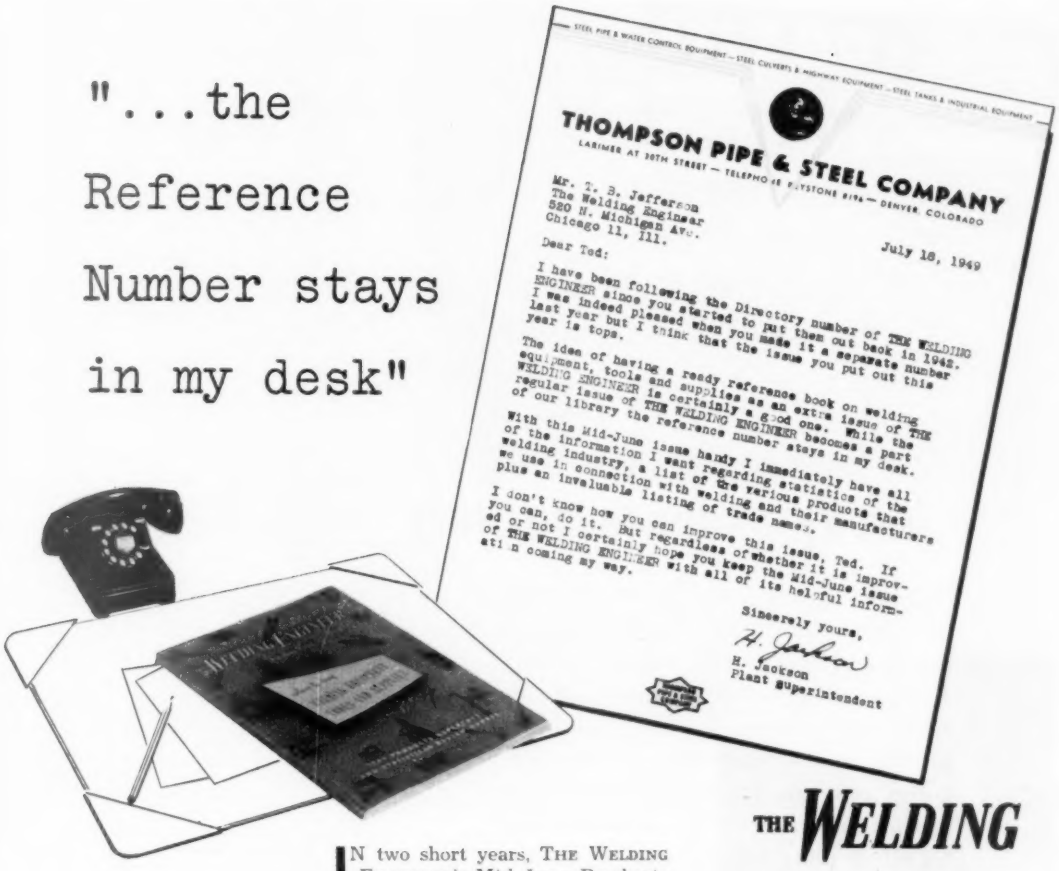
Steels containing high percentage of chromium and nickel were quite resistant to corrosion. No appreciable weight loss or pitting was detected after 14 years. Immunity to corrosion shown by small test specimens does not necessarily mean that a large structure will last indefinitely, caution the investigators. The effect of expanding area on the depth of pitting has not yet been worked out for high-alloy steels.

Measurements of the corrosion of wrought-iron specimens indicate that small amounts of chromium, nickel and molybdenum add little to their corrosion resistance underground.

Progress of corrosion with time was found to range from cessation after a short period to continuance at a rate proportional to the length of exposure, depending on soil conditions. A high initial rate of erosion if it soon decreases may not shorten the life of a buried structure as much as a low initial rate that shows little or no decrease with time.

One environmental condition which has a strong influence on pitting and weight loss with time is aeration. Since the initial rate of piping corrosion in soils depends on accessibility of oxygen to the metal surface, this rate is greater in well-aerated

"...the Reference Number stays in my desk"



THOMPSON PIPE & STEEL COMPANY
LARIMER AT 20TH STREET — TELEPHONE KEYSTONE 8184 — DENVER, COLORADO

Mr. T. B. Jefferson
The Welding Engineer
520 N. Michigan Ave.
Chicago 11, Ill.

July 18, 1949

Dear Ted:

I have been following the Directory number of THE WELDING ENGINEER since you started to put them out back in 1942. I was indeed pleased when you made it a separate number last year but I think that the issue you put out this year is tops.

The idea of having a ready reference book on welding equipment, tools and supplies as an extra issue of THE WELDING ENGINEER is certainly a good one. While the regular issue of THE WELDING ENGINEER becomes a part of our library the reference number stays in my desk.

With this Mid-June issue handy I immediately have all of the information I want regarding statistics of the welding industry, a list of the various products that we use in connection with welding and their manufacturers plus an invaluable listing of trade names.

I don't know how you can improve this issue, Ted. If you can, do it. But regardless of whether it is improved or not I certainly hope you keep the Mid-June issue of THE WELDING ENGINEER with all of its helpful information coming my way.

Sincerely yours,

H. Jackson

H. Jackson
Plant Superintendent

IN two short years, THE WELDING ENGINEER'S Mid-June Products Reference and Statistical Review Number has become an integral part of the purchasing function of the welding industry. Welding distributors, users and manufacturers refer to this handy, authoritative products reference throughout the year.

The Products Reference Number is designed for you — it's the only buyers' guide specifically tailored to your daily buying requirements. The detailed listings of products, trade names and manufacturers' addresses are an invaluable aid in locating the welding items you have to buy.

The descriptive product advertisements are a plus value in selecting your product needs. And they're conveniently placed next to the corresponding product classification. Here you'll find helpful "catalog" information on specifications and applications — all designed to help you select the right product for the right job. These ads are your guideposts to dependable sources for welding equipment, apparatus and supplies.

The special Statistical Review Section is packed with comprehensive data on welding production, sales and markets — making this issue doubly important wherever welding products are purchased or sold.

The new 1950 Products Reference and Statistical Review Number "with all of its helpful information" will be coming your way in June. Make sure your copy "stays in *your* desk" the year 'round.

THE WELDING ENGINEER

Mid-June Products Reference Number

REPRESENTATIVES

New York — C. H. Clarke
330 West 42nd Street
Tel. Longacre 4-3000

Cleveland — E. J. McOsker
1510 Hanna Building
Tel. Superior 1-7000

Chicago — T. H. Barry
520 N. Michigan Ave.
Tel. Whitehall 4-7900

Los Angeles — C. W. Dysinger
621 So. Hope St.
Tel. Michigan 3691

San Francisco — J. W. Otterson
68 Post St.
Tel. Douglas 2-4600

Dallas — J. H. Allen
First National Bank Building
Tel. Prospect 7-0564

in handy 5-ounce packets

Now you can get this versatile fast-acting low-temperature silver brazing alloy in convenient, sturdy 6½" square packets. Just the thing for—small shops—plumbers — refrigeration, electrical and other service men—maintenance and repair crews, etc. Also for all shops that make ferrous and non-ferrous metal products for silver alloy brazing trial work, tool repairs, etc. Each package contains a 5-ounce coil of 1/16" EASY-FLO 45 wire (approximately 330 lineal inches)—also torch brazing instructions and a "Quick Facts" folder giving full details about EASY-FLO 45.

WRITE TODAY FOR OUR LIST OF DEALERS

and order a supply of packets from the nearest one.

HANDY & HARMAN
FOUNDED 1867 QUALITY SERVICE

HANDY & HARMAN
82 FULTON STREET • NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

soils than in a poorly drained soil deficient in oxygen. Excess oxygen, however, causes the formation of layers of corrosion products in close contact with the corroding areas, with the result that the corrosion rate soon goes down if it's not actually stopped.

The change in the rate of corrosion with time is of practical importance. If a section of pipe is exposed to conditions that soon cause corrosion to stop, life of the pipe might be made infinite just by doubling the wall thickness. On the other hand, if by doubling the thickness of the metal, only a twofold increase in life could be secured, cost of the extra thickness would not be justified.

From tests, the Bureau of Standards has developed an empirical equation for expressing the corrosion of iron, steel, copper, lead and zinc. One constant is the initial rate of corrosion and the other is the rate of progress of corrosion with time.

* * *

Tube Turns Moves at Tulsa

TULSA office of Tube Turns, Inc., has been moved from 317 South Detroit Avenue to 420 Wright Building. Robert S. Tyler, Jr., is manager of the company's Tulsa office.

* * *

New Distributor Appointments

THE FEDERAL MACHINE AND WELDER CO., Warren, O.: Austin-Hastings Co., Inc., Cambridge, Mass., for Maine, Vermont, Massachusetts, New Hampshire, Connecticut and Rhode Island.

PRECISION WELDER & MACHINE CO., Cincinnati, O.: Upton, Bradeen & James, Ltd., Montreal, Canada as exclusive representatives for Canada. Arcos, Inc., Philadelphia, has also been named by Precision as representative in eastern Pennsylvania, southern New Jersey, Delaware, Maryland, District of Columbia and eastern Virginia.

SCHRAMM, INC., West Chester, Pa.: Victor Equipment Co., San Francisco, for southern California.

REYNOLDS METALS COMPANY, ALUMINUM DIVISION, Louisville, Ky.: Mutual Mfg. & Supply Co., Cincinnati 25; American Steel & Alloys Corp., Hartford 5, Conn.; Merchant & Evans Co., Philadelphia, Pa.; Athos Steel Service Co., Philadelphia.

AMERICAN PLATINUM WORKS, Newark, N. J.: Fort Duquesne Steel Co., Pittsburgh and The Hamilton Steel Co., Cleveland, for silver brazing alloys in Ohio, West Virginia, Kentucky, western Pennsylvania and the area around Jamestown, N. Y.

* * *

GRAHAM MFG. CORP., Ferndale, Mich., has appointed the following distributors for its stud welding equipment: Electronic Engineering Company of California, Los Angeles 5; E. O. Larson, Boston 18; Welding Engineering Sales Corp., New York City 17; Bowser International, Ltd., London, W. 1., England; Arcway Equipment Co., Philadelphia 42; John M. Diebold, Cleveland 3; S. F. Bowser, Ltd., Hamilton, Ontario; Robert W. Hoffman Co., Inc., Chicago 6; Frank L. Shoemaker, Seattle 4, Wash.; E. C. Caluwaert, O.K.I. Welding Supply Co., Cincinnati 10 and Harry B. Hammond, Ypsilanti, Mich.

OXYGEN AND ACETYLENE at 10% to 50% Discount

● Harris Automatic Welding Torches represent the biggest advancement in torch design since the original Torch. By means of a thumb controlled lever, the full flame is extinguished when not needed (except for a tiny acetylene pilot light) and relit instantaneously, without need for re-adjustment.

Every time the lever is used, money (oxygen and acetylene) and time are saved. Basically, that's why thousands are in use, especially on production welding work. The original cost of a Harris Automatic is saved many times over during its lifetime.

Further, the seven styles and sizes available are unusually good torches, characterized by exceptional flame range from each size of tip, freedom from "popping" and flashback and stand continuous operation under severe conditions.

Why use 1938 (or older) torches under 1948 conditions? Write us, or contact your nearest Harris Distributor for free demonstration.

THE HARRIS CALORIFIC COMPANY
CLEVELAND, OHIO

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905

"TWO HEADS ARE BETTER THAN ONE"

Multi-Pic
HAS FIVE HEADS
giving
you
FIVE TIMES FASTER CLEANING ACTION

FIVE-FOLD EFFICIENCY

See how Multi-Pic's five free-floating heads *conform* to the surface being cleaned—how the entire head surface is actively cleaning instead of just one or two "high" spots. Actual tests prove Multi-Pic to be from two to five times as fast in weld cleaning as conventional hammers.

FIVE-FOLD ECONOMY

Multi-Pic's free floating hammer heads absorb wear *uniformly* — outlast single headed hammers many times over. Handles last indefinitely and, when heads finally do become worn, they can be resharpened easily on an ordinary grinding wheel.

Multi-Pic hammer heads are made from tough, fine grain, high quality tool steel, precision hardened throughout to 54-56 Rockwell C.

NATIONAL WELDING SUPPLY ASSOCIATION MEMBER

See Multi-Pics at better Welding Distributors everywhere or write Bernard Welding Equipment Company, 741 E. 71st Street, Chicago 19, Illinois, for descriptive folder.

BERNARD WELDING EQUIPMENT CO., CHICAGO 19, ILL.

Electric Ovens Anneal Turbo-Jet Engine Parts

SOLAR AIRCRAFT CO., San Diego, Calif., recently installed two rectangular pit ribbon-resistor electric furnaces for annealing welded aft-frames of turbo-jet engines. Fabrication of these frames requires a carefully controlled annealing cycle to relieve stresses within the stainless steel frames.

The furnaces operate with a protective atmosphere and anneal four frames at once, two to a furnace. The atmosphere consists of carbon dioxide, nitrogen, carbon monoxide and a small quantity of hydrogen.

Frames are put into the frames and removed at a temperature below 500 F; thus no objectionable oxidation of surfaces can occur. Heat-treating cycle consists of heating the frames to 1,650 F at the rate of 100 F per hour and holding it at this heat for 3 hours. At the end of this time, the power input to the ribbon resistors is cut off. The atmosphere gas cooler then cools the furnaces at the rate of 200 F per hour to 500 F.

* * *

Atomic Commission Releases Welding Fixture Patent

PATENT for locating and welding fixture for use in various valve parts in atomic energy plants has been made available for licensing by the Atomic Energy Commission. Patent number is 2,431,732, and the inventor is Edward Colbert. If you want to license it, write to the Chief, Patent Branch, Office of the General Counsel, U. S. Atomic Energy Commission, Washington 25, D. C.

* * *

Welding Distributor Moves

CORP. Brothers, Inc., moved recently to its new office, store and warehouse at 1 Brook St., Corner of India St., Providence, R. I.

* * *

RADIANT-HEATED sidewalks around New York City's 100 Park Avenue building will melt snow and ice in winter time. Water and anti-freeze circulate through 9,000 linear ft of welded piping buried in the sidewalks. For details, see page 25 in this issue

THIS MAN WOULDN'T NEGLECT

A MACHINE IN HIS PLANT

...yet he hasn't had a Chest X-Ray!

He checks every piece of mechanical equipment he owns for wear, lubrication, efficiency.

Yet he fails to take the simple precaution of a Chest X-Ray to make sure he does not have tuberculosis. *Not because he's opposed to the X-Ray. Simply because he is not sufficiently informed—or just hasn't taken the time and trouble, or does not realize the seriousness of the problem.*

A Chest X-Ray is the first step toward detecting tuberculosis in its early stages. And in its early stages it can be cured with the least loss of time from work.

So, if you're the man above, that one simple reason should make you get your Chest X-Ray—*today*. But listen, see how serious this really is:

Between the ages of 15 and 34, tuberculosis leads all other diseases as a cause of death—although at no age are you safe from TB. Yet, if everyone does his part by getting a Chest X-Ray periodically, and the majority of cases thus discovered are followed up, we can eliminate TB entirely as a public health hazard!

Will you do your part today? Get a Chest X-Ray. It may mean your life!

Published in the public interest by:

McGRAW-HILL PUBLICATIONS

Specify CMD CHIPPING HAMMERS
— The Finest Tools Made for EVERY Weld Cleaning Need

TYPE CB . . . A favorite for many years, this hammer is 3 tools in 1—drift, chisel, and removable wire brush.

TYPE A . . . Drift and chisel of high-grade steel. Popular in malleable and grey iron foundries.

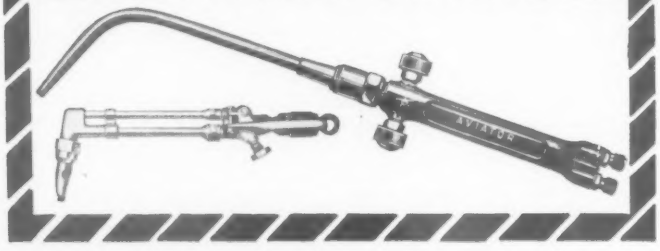
TYPES EB and **FB** . . . models E and F can be supplied with brush as shown here. Brush can be replaced.

TYPE E . . . head of high-grade steel has drift and chisel. Special hand grip absorbs shock.

Order from your dealer. Write today for descriptive circular W-3.

CHICAGO MANUFACTURING & DISTRIBUTING CO.
1928 WEST 46th STREET • CHICAGO 9, ILLINOIS

the AVIATOR JET



a double-duty torch for your light welding and cutting

The "Jet" is as new and different as its name implies . . . designed for two operations from a single torch. It consists of two units, with the cutting attachment identical to that used with the famous WELDMASTER Torch, scaled down for lighter duty. For precision work with an eye on economy—*you'll want* the new MECO Aviator Jet.

We invite your inquiries.

Meco
Modern Engineering CO., Inc.
3411-C PINE BLVD. ST. LOUIS 3, MO.

Shopmen's Library Offered by Commerce Department

A MINIATURE "shopmen's library" of technical bulletins on welding and brazing, soldering, milling, spinning, honing, plating, etc., is offered by the Office of Technical Services of the Department of Commerce. A total of 54 bulletins is included. A combined order blank and reservation form, "Industrial Note Circular," is available from the OTS.

• • •

"Easy on the Eyes" Title of Safety Film

NEW training film entitled "Easy on the Eyes" convinces the most skeptical workman that it's smart to wear safety glasses. It asks them to realize what their eyes mean to them, then shows how easily eyesight may be lost. What type glasses are best for specific jobs, case histories of injured workers and testimonies of blind persons are also given. The film is available in 35-mm sound-slide film and in 16-mm sound movies. Information about purchase, preview or rental is obtainable from the National Safety Council, 20 North Wacker Drive, Chicago.

• • •

93,000 Freight Cars Delivered in 1949

INCLUDING estimated December deliveries, a total of 93,350 new freight cars were delivered to American railroads in 1949. Passenger car deliveries were up about 6% over 1948, totalling an estimated 950 for 1949.

Of the 93,000 freight cars, more than 62,000 were made by the car builders and 29,000 by railroad shops. The backlog of unfilled orders for freight cars as of December 1, 1949, was 14,146. This compares with a backlog of 103,896 at the beginning of the year.

• • •

Brake Shoe Consolidates Canadian Subsidiaries

AMERICAN BRAKE SHOE COMPANY has consolidated all operations of its Canadian subsidiaries into one corporation, the Dominion Brake Shoe Co., Ltd., a wholly-owned subsidiary. Operating division of the Canadian plants will be Brake Shoe, Joliette Steel, Canadian Ramapo, American Brakeblok and Kellogg. Principal office of Dominion Brake Shoe Co., Ltd., will be 1405 Peel St., Montreal.

• • •

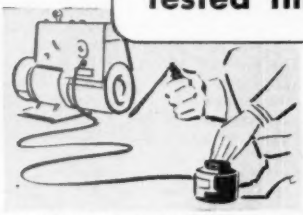
Schwartz Joins Distributor as Secretary

A. C. SCHWARZ, formerly with Metal and Thermit Corp., San Francisco, has joined California Welding and Equipment Co., San Francisco, as secretary.

President of the company is Robin Bradley. California Welding and Equipment Company is the San Francisco distributor of Metal and Thermit electrode and welders, Tweco and Jackson welding accessories, Thor tools and National Cylinder Gas compresses gases.

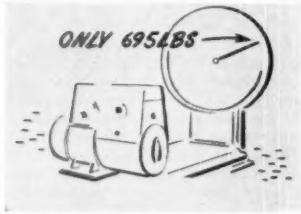
P&H gives you

the only DC Arc Welder with *all* these tested time- and money-saving features

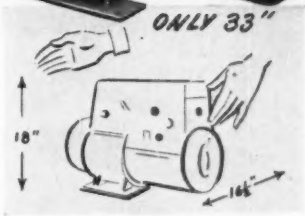


BUILT-IN REMOTE CONTROL Dial-lectric feature gives full arc-control at the work . . . saves operator's time . . . saves floor space for production.

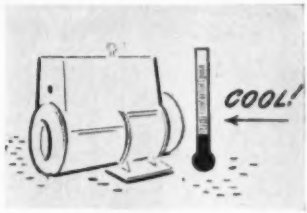
SLOW SPEED Lowest rpm per pound of weight. Only 1750 rpm for less wear, longer life, and minimum replacement costs. So quiet you hardly hear it.



LIGHT WEIGHT Easy to handle and move. Facilitates mounting off the floor and out of the way so there's more room for turning large weldments. Weighs only 695 lbs.



STURDY AND COMPACT Four sets of main brushes and one auxiliary set firmly fastened for good commutation. Simple design and rigid construction throughout . . . space-saving dimensions.



COOL OPERATION Slow speed plus extra large stator-frame cooling surfaces, and dual fans (for generator and motor) — make this the coolest welder you have ever seen.

● Stationary or portable mountings—Additional Features: single heat control; life-time sealed bearings; push-button start- and -stop switch with overload protection; high-low range switch; and polarity reversing switch. Get all the facts. Call your P&H representative, or send in coupon.

P&H **WELDING DIVISION**
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

Uniform, top-quality electrodes for every job!

TEAR OUT COUPON AND MAIL TODAY!

HARNISCHFEGER CORPORATION, Welding Division 2517
4513 W. National Ave., Milwaukee 14, Wisconsin

Please send me Bulletin W-80 giving full details about the outstanding new P&H WFA-300 DC arc welding machine.

Name.....

Company.....Title.....

Address.....Home ☐ Business ☐

City.....(.....) State.....

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZER • CRAWLER AND TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES

For HIGH TENSILE STRENGTH, MACHINABLE WELDS

Ask Your Distributor for

Fuse-Well

PLAIN AND ALLOY CAST IRON

WELDING RODS

ELECTRODES • MOLY RODS

- Perfect Color Match
- Like Expansion and Contraction

Fuse-Well

Cast Welding Rods

CAST ALUMINUM RODS & FLUXES

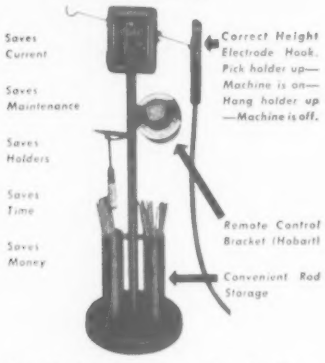
THE CHICAGO HARDWARE FOUNDRY CO.

"Dependable Since 1897"

2050 Commonwealth Ave. NORTH CHICAGO, ILLINOIS

SAVE MONEY with HOBART accessories

Electro-Mizer



The Electro-Mizer is a Remote Stop-Start Switch combined with other "at-hand" conveniences. Write for amazingly Low Price and Data Sheet.

Electrode Holders

Hobart offers the complete line of Nationally advertised Holders.

For additional information on Hobart Accessories see your Hobart Distributor or write

HOBART BROS., BOX U-501, TROY, OHIO

NEW PRODUCTS

(Continued from page 46)

Low-Cost Welding Cable Offers Flexible Operation

A LIGHTWEIGHT welding cable with a green cellophane separator is said to assure flexibility by allowing free movement of the conductor within the rubber sheath. Rope strand construction of copper conductor also aids flexibility.

The new type D866 cable is claimed to be resistant to sunlight, impact, abrasion and repeated flexing. It is available in sizes 6 through 4/0 AWG in coils or on reels.

GENERAL CABLE CORP., 420 Lexington Ave., New York City 17.

* * *

Can Lower Amperage With "Eutectrode 24"

AN IMPROVED "Eutectrode 24" may be used with only 80-90 amp instead of the minimum 120-125 amps formerly required. Lower amperage reduces the risks of stress and distortion but will not affect arc stability, rate of deposition or flatness of the bead, state Eutectic technical men.

The new "24" electrode will have the words "Formula 1950" affixed to its name. It is recommended for repairing and salvaging machinery and castings of all types. Its tensile strength is 50,000 psi; hardness 150-200 Brinell.

EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York City 13.

* * *

New Compound Hardens Parts by Dipping

NEW hardening compound called "Hard-N-Deep" is said to put a 1/32-in. case-hardened layer on steel by a very simple method. The part to be hardened is heated to a cherry red, dipped in the compound, brought back to temperature and quenched. An even deeper layer than 1/32 in. can be hardened by repeated treatments, say company officials.

The compound is said to produce a combined carbonizing, nitriding and chromizing action under heat. It comes packed in 1, 3, 5 and 10 lb cans or in 25, 50 and 100 lb drums.

THE MIRACALOY CORP., 50 Broadway, New York City 4.

* * *

Pipe Threader Featured By Automatic Centering

IMPROVED portable pipe and bolt threader called the "Quijada Chief" has four jaws in front to grip the pipe and four rear jaws to center the pipe. The chucks are operated automatically when the improved push-pull switch is actuated. It will take pipe of from 1/2 to 2 in. OD, utilizing a die head for each size of pipe. A reamer attached to each head reams while threading. When the proper length of thread has been cut, a bell rings to notify the operator to open the die head.

QUIJADA TOOL CO., 5474 Alhambra Ave., Los Angeles 32.

About People

H. E. PIGGOTT has been elected president and general manager of Dockson Corp., Detroit, by the board of directors. Mr. Piggott has been with Dockson for 27 years. He began as a shipping clerk in 1923 and has been purchasing agent, salesman, director of sales, vice-president and general manager.

* * *

EDWARD DASH, welding engineer with the Navy Department for 10 years, is now with the Shielded Stud Welding Co., Los Angeles. He is a charter member of the Long Beach section of AWS and is also a member of the ASM.

* * *

CHARLES METZ has been appointed resistance welding engineer for Machinery & Welder Corp., which has offices in St. Louis, Moline, Chicago, Milwaukee and Minneapolis.

* * *

CLAUDE E. MONLUX, vice-president, The Linde Air Products Co., New York City, was elected president of the International Acetylene Association at the annual meeting in San Francisco, March 27-29. (For more details about the convention, see Page 35)

* * *

GEORGE H. DAVIS has joined the iron and non-ferrous casting section of the development and research division of The International Nickel Co., Inc., New York City. He will work with nickel electrodes development.

* * *

J. A. ALLISON, formerly of A. C. Geldner & Co., has been appointed sales representative for the states of Oregon and Washington by Titan Metal Mfg. Co., Bellefonte, Pa. Mr. Allison has two offices, one at 203 White-Henry-Stuart Bldg., Seattle, and the other at 614 Medical Arts Bldg., Portland, Ore.

* * *

DONALD A. WATSON has been appointed assistant sales manager of Metallizing Engineering Co., Inc., Long Island City 1, N. Y. He has been with the company for 15 years. HARRY A. COLLINS has been named eastern regional manager covering the sales territory from Maine to Florida. He has been with Metco since 1941.

* * *

ARTHUR L. LARSON has been named assistant to the sales manager of The Falk Corporation, Milwaukee. He also becomes manager of the sales inquiries division. WILLIAM J. URBAN, has been appointed manager of coupling sales. The new manager of distributor sales is DON K. LAMBERT. ROLAND E. GOVAN heads sales promotion.

WELD OR CUT *Better*

with this versatile **Gasweld**

Registered in U. S. Patent Office

ALL-PURPOSE OUTFIT for General Work

It's ideal for job shops, garages and other places where a wide variety of welding is done. Rugged, heavy-duty torch, 17" overall, weighs 24 ounces. The WC-20 Cutting Attachment widens the utility of this handy outfit. Users find it just right for field work where portability is essential. All mixers and cutting attachments connect to the torch handle with a *neoprene seal* at the union connection.

Standard Heavy-Duty Cutting Attachment

Head mixer, tip nut and tip, needle valve, oxygen valve and lever are the same as in our standard cutting torches. This assures top cutting efficiency and rugged durability in this popular combination outfit.

WG-2544 GENERAL WELDING OUTFIT

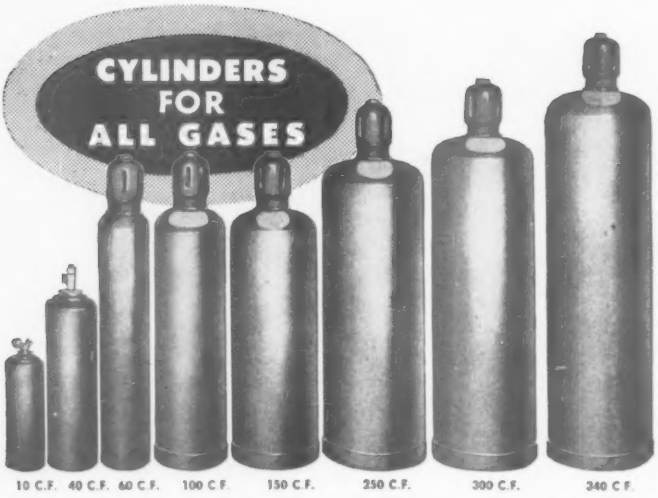
Welding Torch is supplied with four goose-neck tips, as selected, from Nos. 1 to 6. Outfit includes: Model RO-44 Oxygen Regulator, Model RA-44 Acetylene Regulator, one pair WM-6 Goggles, two 12½ foot lengths of ¼" hose with connections, one WM-25 Safety Spark Lighter and one RF-77 Combination Wrench. One WC-20 cutting attachment and one tip.

WG-2544—Complete Welding and Cutting outfit **$97.50**
Welding outfit only **$75.00**

Write for complete catalog of welding and cutting equipment and supplies.

LISTED Underwriters Laboratories

THE LIQUID CARBONIC CORPORATION
Industrial Gas Division
3110 South Kedzie Avenue • Chicago 23, Illinois
Branches and Dealers in Principal Cities
ORDER THROUGH YOUR LOCAL JOBBER OR WRITE US DIRECT



INDEPENDENT Acetylene Cylinders take from 5 to 10% more gas. Uniformity of monolithic filler insures even distribution of acetone. Storage cylinders available in 12′ and 20′ lengths, of 850 and 1,500 cu. ft. capacities.

INDEPENDENT ENGINEERING COMPANY, Inc.

CONSULTING · RESEARCH · DESIGNING

Manufacturers of

CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN

O'FALLON 5, ILLINOIS

We Invite Your Inquiries

National

Carbide

EFFICIENT

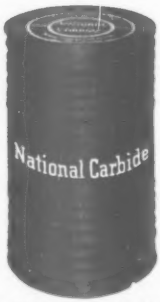
ECONOMICAL

DEPENDABLE

for

Welding & Cutting

SPECIFY



NATIONAL CARBIDE IN THE RED DRUM

Write us for information as to nearest available stock.

NATIONAL CARBIDE COMPANY

A Division of Air Reduction Company, Inc.

60 E. 42nd St., New York 17, N. Y.

COLONEL HARRY T. HANOVER has been appointed factory representative in the northern California district for the Mir-O-Col Alloy Co., Los Angeles 21. His headquarters are at 449 Bryant St., San Francisco.

* * *

WILLIAM C. ETHEREDGE has been named general staff manager, general sales department of the United States Steel Supply Co., Warehousing subsidiary of United States Steel Corp.

* * *

PROF. RALPH G. HUDSON, member of the department of electrical engineering at Massachusetts Institute of Technology since 1907, will retire in July. From 1917 to 1918 he was director of research for the Electric Welding Committee of the Emergency Fleet Corp. He received the James F. Lincoln Arc Welding Foundation award in 1948 for notable contributions to engineering literature.

* * *

GRESWOLD VAN DYKE has been appointed executive director of Stainless Steel Producers—American Iron and Steel Institute. For 29 years he was with Joseph T. Ryerson & Sons, Inc., Chicago where he was manager of the special steel division.

* * *

DR. CARL E. SWARTZ, division engineer of the Kellex Corp., New York City, has been named chairman of the metals research department of Armour Research Foundation of Illinois Institute of Technology, Chicago.

* * *

F. J. ABROMITIS and H. F. MCNEIL have been elected to board of directors of the J. C. Menzies & Co., Inc., Chicago. DELORES E. SOSNOWSKI has been appointed assistant secretary of the corporation.

* * *

A. G. HENDRICKSON has been named assistant sales manager of the P&H welding division of Harnischfeger Corp., Milwaukee. He was farm bureau consultant on welding for a year and a half and has had five years experience as a welding engineer in the Milwaukee and Minneapolis territories.

* * *

EUGENE G. SHEASBY has been appointed assistant district manager for the Pittsburgh district of the United States Steel Supply Co., warehousing subsidiary of United States Steel Corp.

* * *

EUGENE S. DUFFIELD has resigned as senior vice-president of the publications division, McGraw-Hill Publishing Co., in order to return to the newspaper field. He will be assistant publisher of the *Cincinnati Enquirer*.

* * *

PAUL MONTGOMERY, vice-president of the McGraw-Hill Publishing Co. and publisher of *Business Week*, has been appointed senior vice-president of the publications division in order to succeed Mr. Duffield. Mr. Montgomery has served the company with distinction for sixteen years, first as manager of *Business Week* and, since May 1945, as its publisher.

M. Russell Kambach has been named advertising manager of Aluminum Company of America. His former position of assistant advertising manager will be taken by Jay M. Sharp.

* * *

F. Carl Saacke has been appointed safety engineer for Air Reduction Co., Inc., New York City. He will review equipment used and sold by the company for safety factors and will be concerned with plant safety programs and employee interest in them. He joined Airco in 1931. Since 1946 he has been a research and development engineer.

* * *

John E. Payne has been named manager of the Westinghouse Electric Corporation's Central District. His headquarters will be in Pittsburgh. He is a member of the Engineers' Society of Western Pennsylvania.

* * *

Paul L. McCulloch, Jr. has been transferred to the Pittsburgh, Pa., district sales office of American Brake Shoe Co. to serve as sales engineer for the American Manganese Steel and Electro Alloys Division. He is replacing M. A. Zeller who has resigned from the company.

* * *

A. L. Roberts has been appointed general superintendent of the Texas Gas Transmission Corp. pipe line system. H. L. Stowers has been named chief engineer for the company.

* * *

Harvey B. Jordan has been elected president of American Steel and Wire company, United States Steel subsidiary.

* * *

Dr. Robert F. Mehl, director of the Metals Research Laboratory and head of the metallurgical engineering department of Carnegie Institute of Technology has been appointed a member at large of the National Research Council of the National Academy of Sciences.

* * *

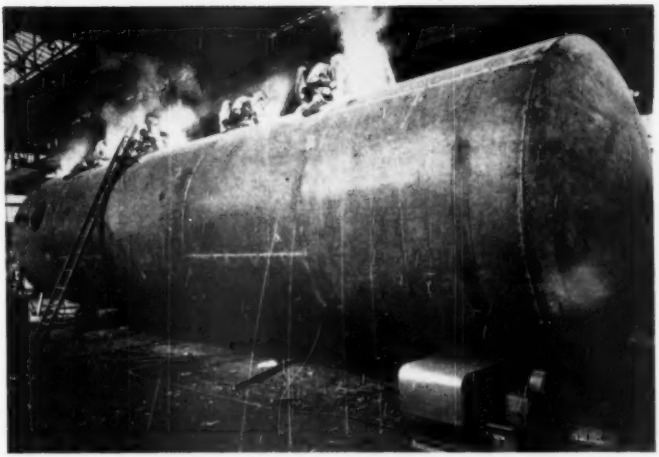
Francis B. Foley, formerly of the Midvale Co., Philadelphia, has joined the staff of the research laboratory of the International Nickel Co., Inc., Bayonne, N. J., as consulting metallurgist.

Died . . .

C. H. Buckmaster, 43, district manager for Lincoln Electric Co. in Detroit, died March 27 from injuries received in an auto accident. He had been with Lincoln for 20 years, 16 of which were spent in the Detroit area developing the use of welding in the tool and automotive industries. He was a mechanical engineer, a graduate of Iowa State College. He is survived by his widow and three children.

* * *

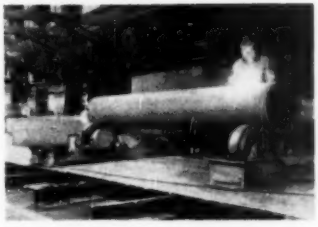
Dr. Merle Randall, 62, director of the research laboratory of the Stuart Oxygen Co., Berkeley, Calif., died on March 17. He was an active member of the San Francisco section of the American Welding Society.



Less Handling—More Welding

It's handling that costs most in welding . . . the crane work or manual labor in positioning the pieces—plus the welder's *waiting* time.

Get more arc-time from every hour by using Worthington-Ransome Turning Rolls to handle tanks, drums or any type of cylindrical vessel regardless of size. They continually bring the work into position for efficient, economical *downhand* welding (manual or automatic) with heavier electrodes which means fewer passes and better welds.



50% greater production on both repetitive and job work has been reported by users.

Capacities from 3 to 75 tons, up to 14 ft. diam., stationary or self-propelled. (Rolls for heavier or larger work also available.)

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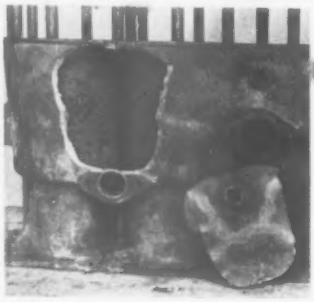
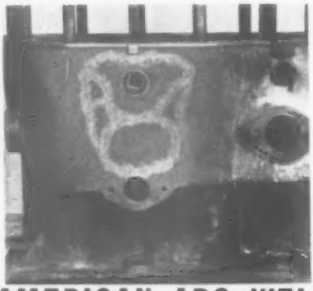


BEFORE
Hours of labor saved by using about 4 pounds of NICO ELECTRODES—this truck motor block is now as good as new.

AFTER



Hundreds of dollars saved on this welding repair job

NICO ELECTRODES

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NO PRE-HEATING

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Book Reviews

Welding Handbook

WELDING HANDBOOK, Third Edition. Published by The American Welding Society, New York, 1950. Cloth; 6 x 9 in.; 1,650 pages. Price $12 in United States and Canada, $13 elsewhere.

New information and a completely new format make the third edition of the Welding Handbook useful to anyone connected with welding. More than 250 welding experts contributed the results of personal and company research and experience to the book.

All welding and cutting processes in use in industry today are thoroughly described in 27 chapters. Information on each process covers equipment used, principle of operation and industrial applications. Ferrous and non-ferrous metals commonly welded are discussed in 13 chapters. Metals covered include iron, wrought iron, carbon and low alloy steels, chromium steels, manganese steels, nickel steels, aluminum, magnesium, copper, nickel, lead, zinc, clad steels, applied liners, etc.

A group of 11 chapters is devoted to design, material workmanship, inspection and production. Individual chapters are presentations of welding physics, metallurgy, costs, terms and definitions, standards, filler metal specifications, etc.

More than 300 tables contain reference data on every phase of welding.

A 69 page index aids the reader to find both specific information and related topics at a glance. Both index and text are extensively cross-referenced.

* * *

Design

STRUCTURAL DESIGN IN METALS. By Clifford D. Williams and Ernest C. Harris. Published by Ronald Press Co., New York, 1949. Cloth 6½ x 9 in.; 596 pages. Price $6.50.

Structural Design of Metals is the first book to result from the James F. Lincoln Arc Welding Foundation contest to produce modernized engineering text books. Subject matter and presentation make this new book suitable for study by the third year engineering student.

A new approach to the problem of structural design is developed here with the emphasis on details rather than the complete structure. The authors feel that details, if properly designed, are as applicable to one structure as another. Therefore they have approached the subject of structural design by stressing the statics of simple structures and the strength of materials.

The authors have developed a book which treats welding and riveting on an equal footing. Welded and riveted details are analyzed in various aspects of the design problem.

Line drawings, graphs and tables supplement the text. Six standard codes and specifications for various types of structures, including the AWS Standard Code for Arc and Gas Welding in Building Construction (1946), are contained in the appendix.

Design

WELD DESIGN. By Harry D. Churchill and John B. Austin. Published by Prentice-Hall, Inc., New York, 1949. Cloth; 5½ x 8½ in.; 216 pages. Price $6.65.

Weld Design was written primarily about the design of welded machine bases. Since such principles apply to other types of design, the authors attempt to treat the subject from both the practical and theoretical standpoints. Importance of the proper choice of components in economical welding design is emphasized.

Clear descriptions of the many processes, shapes and materials entering into machine-base construction are included.

* * *

Titanium

TITANIUM. By Jalks Barksdale. Published by Ronald Press Co., New York, 1949. Cloth; 6½ x 9 in.; 591 pages. Price $10.

Titanium, the newest commercial metal, has been given a comprehensive treatment in this volume. The book is a practical working reference concerning titanium's uses in the paint, ceramics and electrical industries. Every quality of the metal, with the exception of the analytical chemistry involved, is covered in detail. The scope of the research which went into the production of this book is indicated by the fact that the bibliography alone takes up 78 pages.

Titanium plays a more important part in welding than this book would indicate. Only brief treatment is given to titanium dioxide as an important ingredient of welding electrode coatings. Nothing is said about the welding of titanium—a fabrication process which will be important in the future uses of this light, corrosion-resistant metal.

* * *

Spanish Dictionary

ENGINEER'S DICTIONARY, Second Edition. By Louis A. Robb. Published by John Wiley & Sons, Inc., New York, 1949. Fabrikoid; 5½ x 8½ in.; 664 pages. Price $12.50.

This dictionary includes the Spanish-English and the English-Spanish equivalents of the engineer's vocabulary. It has been expanded from the first edition to cover more electrical and mechanical engineering terms. Radio and television terms, entirely omitted in the first edition, have been added. Since welding is playing an increasing part in all engineering, there is also included a complete list of equivalent welding terms.

All civil engineering terms have been brought up to date with special attention being given to photogrammetry, soil mechanics and airport construction. Important words peculiar to mining, shipbuilding, logging, sugar milling and oil field operations are listed. A few helpful and practical terms in finance, insurance and transportation are included.

English definitions are given only in default of a satisfactory equivalent or to avoid ambiguity. The author assumes that the reader knows what he is talking about and is looking only for its equivalent in Spanish engineering language.

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There are "Missing Link" Models for 0-300 Amp and 0-600 Amp Welders.

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THE WELDING ENGINEER

330 W. 42nd St. **New York 18, N. Y.**

30 YEARS AGO

(From THE WELDING ENGINEER of May, 1920)

An advantage advertised by an Ohio firm now hiring weldors is its standard 59-hour work week.

—30 YEARS AGO—

New device for testing boiler tubes consists of two movable pistons connected by a hollow perforated rod. The pistons are inserted into the tube so that one is on either side of a welded joint. Air is then forced into the space between pistons through the hollow rod. Soap solution painted on the joint will bubble if any air comes through cracks in the joint.

—30 YEARS AGO—

Reprints of two articles titled "Reminiscences of a Weldor" which appeared in 1916 in The Welding Engineer appear again this month. Written by M. Keith Dunham, they combine humorous stories of the early days of welding with practical hints about common welding problems.

—30 YEARS AGO—

Local sections of the American Welding Society are being organized in Cleveland, Detroit and San Francisco. More than 150 applications for membership have come into the Philadelphia section.

—30 YEARS AGO—

Total cost of a welded repair on a high pressure cylinder on a Mallet-type articulated steam locomotive was $215.97. Cracks in the cylinder proper and the valve chamber added up to 14 ft. Cost of a new cylinder, labor and down-time necessary was estimated to be $4,654.

—30 YEARS AGO—

Victor Oxy-Acetylene Equipment Co., San Francisco, has opened offices in Chicago at 10 North Jefferson St.

—30 YEARS AGO—

Welding of farmers' binders, corn planters, mowers and cultivators is reported by a reader. Scraps of metal from old magneto castings work well in the welding of white metal and aluminum, he reports.

—30 YEARS AGO—

A growing tendency of factories to hire their own maintenance welders is reported to the editor. The owner of one of the largest job shops in Chicago says that his business volume is considerably lower because of this trend.

—30 YEARS AGO—

Large numbers of weldors have been trained at the Denver, Colo., Y. M. C. A. welding school for the oil industry in Wyoming, Oklahoma and Texas. Chief instructor is Earl J. Thompson, formerly with the Sun Shipbuilding Co.

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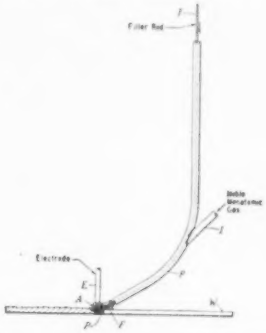
From the Patent Office

Inert-Arc Process

2,496,347. HARRY T. HERBST, Roselle, N. J. Assigned to the Linde Air Products Co. Filed Sept. 5, 1946. Granted Feb. 7, 1950.

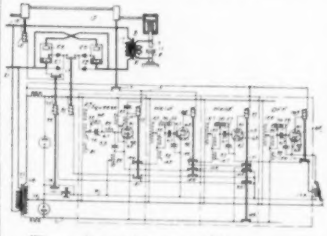


For welding metals with refractory oxides, a newly patented inert-arc process consists essentially of a mechanism for feeding a filler rod to a weld puddle shielded by helium or argon. Improvement comprises introducing an inert gas to the path of the filler rod adjacent the rod inlet. The stream of gas goes along the rod path and prevents contamination of the weld puddle by oxygen carried by said rod. The gas is discharged from the rod projecting end of the path to blanket the weld puddle.

* * *

Sequence Weld Timer

2,498,269. EDWARD C. HARTWIG, Tonawanda, N. Y. Assigned to Westinghouse Electric Corp., East Pittsburgh, Pa. Filed July 3, 1948. Granted Feb. 21, 1950.



Timer for resistance welding apparatus includes an electric discharge device having an anode, a cathode and a control electrode. There is also a capacitor and first and second terminals for connecting to an a-c supply. The first terminal, capacitor and control electrode are connected in series. Second terminal and cathode are also connected in series. Connections are built in to discharge the capacitor and to connect the cathode to the first terminal.

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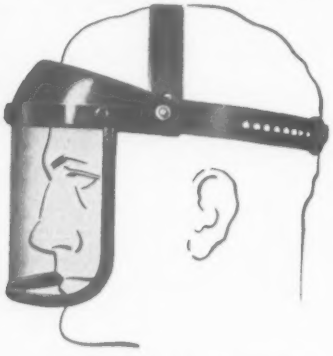

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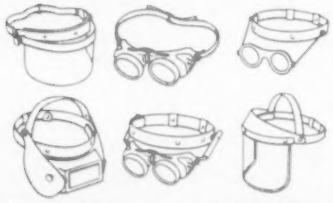

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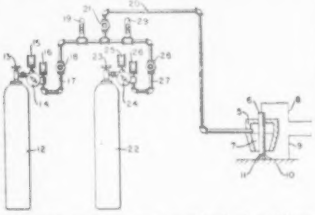
Arc Welding

2,497,631. Gilbert R. Rothschild, Somerville, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed May 14, 1948. Granted Feb. 14, 1950.

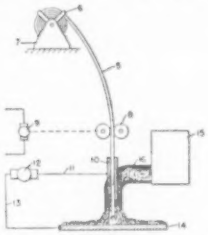


Patent pertains to a method of welding with the metal arc where the arc is surrounded by a protective gaseous shield of a mixture of 1 to 10% hydrogen by volume mixed with a rare gas of the atmosphere other than helium.

* * *

Shielded Arc Welding

2,497,629. Perry J. Rieppel, Worthington, O. Assigned by mesne assignments to Air Reduction Co., Inc., New York City. Filed Dec. 10, 1948. Granted Feb. 14, 1950.

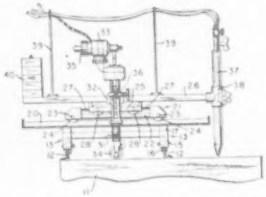


Patent refers to a method of arc welding by maintaining an arc surrounding with a blanket of foam including a gaseous medium.

* * *

Flame Cutting Machine

2,496,110. Oliver Thurman, Jr., Mount Tabor, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed Sept. 3, 1947. Granted Jan. 31, 1950.



A double rectilinear torch machine has a movable base carriage guided to move in a straight line at an angle to the direction of the base carriage. A tracer and a torch are mounted on the upper carriage so that they move together. They are capable of movement in any direction in a plane because of the movability of the carriages. Springs between the upper and base carriages transmit to the latter movements of the former in a direction in which the base carriage is movable.

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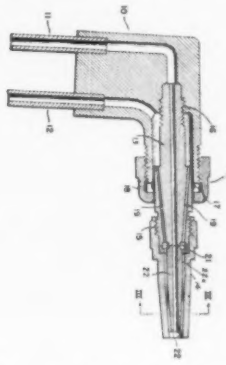
Torch Tip Structure

2,496,923. JOHN D. WALTERS and JOSEPH T. MUENZMAY, Pittsburgh. Filed March 21, 1947. Granted Feb. 7, 1950.

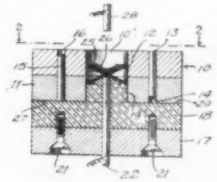


Patent pertains to an acetylene torch tip which has a forward portion of substantially greater diameter than the rear portion. A space is provided to form a communication chamber to another port in the head. Ports extend lengthwise through the base of the tip in directions that converge toward the axial line of the base. A ring-shaped groove in the forward part of the base surrounds the central bore. The end member of the tip has a central bore to fit the bore of the base portion. This end member also has a flange on its rear end and forwardly extending slots on its surface. The flange has ports to communicate with the ring groove. A casing member overlies the said grooves for the forming of passages. The case has threads for connecting to the base member.

* * *

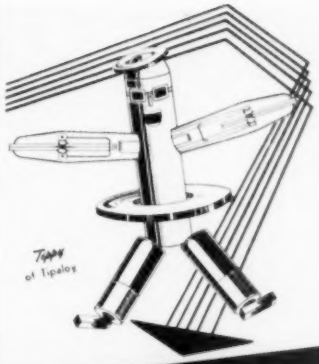
Welding Jig

2,495,758. ALFRED G. PARKER, Summit, N. J. Assigned to Foster Wheeler Corp., New York City. Filed June 22, 1948. Granted Jan. 31, 1950.



Patent covers a jig for the resistance welding of two workpieces, each with a peripheral edge. The workpieces are of such shape and of such material as to be bent without deformation. The jig has two work holding members each having a passage through it.

Relative sizes of the passages and the workpieces are such that the peripheral faces of the passages and the edges of the workpieces engage each other. Positioning means hold one workpiece in the passage of one work holding member while the other article is also moved so that its peripheral edge is in engagement with the surface of the other holding member.



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DIVISION OF THE BURDETT OXYGEN COMPANY • CLEVELAND, OHIO

Magnetic Ground Clamp

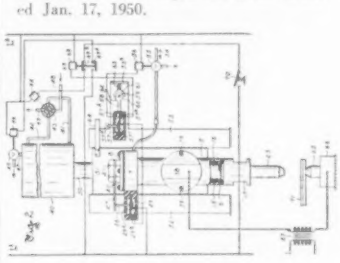
2,489,475. KARL A. BLIND, Thiensville, Wis. Assigned to Dings Magnetic Separator Co., Milwaukee, Wis. Filed Dec. 18, 1947. Granted Nov. 29, 1949.

A new magnetic ground clamp contains electrical current conductors disposed symmetrically with respect to an axis with inner and outer annular pole pieces one within the other coaxially of the axis. The pole pieces are suspended and insulated from the conductors. Pole pieces have spaced flat portions provided with concentric tubular flanges spaced from each other. At the adjacent free edges of the said pole pieces are annular pole faces disposed in a common plane perpendicular to the previously mentioned axis. An annular group of magnetized blocks is contacted and confined between the flat portions of the inner and outer pole pieces. Means interposed between the conductors and the pole pieces constantly force the conductors out beyond the plane of the pole faces.

* * *

R-W Holder Control

2,494,847. JEROME B. WELCH, Wauwatosa, Wis. Assigned to Cutler-Hammer, Inc., Milwaukee. Filed April 21, 1948. Granted Jan. 17, 1950.

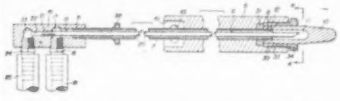


A resistance welding electrode carrier comprises two parts connected by a straight-line, lost-motion device. Contact elements associate with the two parts for control of a circuit connection for the electrode. The contacts are disengaged with the parts in extended relation, and engageable by take-up of the lost motion between the parts. A motor insures take-up of the lost motion.

* * *

Welding Electrode

2,492,578. HAROLD A. JOHNSON, Milan, Ill. Filed May 16, 1949. Granted Dec. 27, 1949.



New patent covers a resistance welding electrode which has a tubular holder and a tip mountable on one end of the holder. A recess in the holder carries cooling water from a pipe attached to the inner end of the tip. The pipe extends axially through the holder and an inner tube extends through the pipe into the recess.

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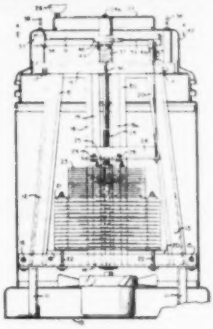
A-C Arc Welder

2,490,871. EDWARD A. HOBART and RUSSELL T. FLORA, Troy, O. Assigned to The Hobart Brothers Co., Troy, O. Filed Aug. 31, 1948. Granted Dec. 13, 1949.

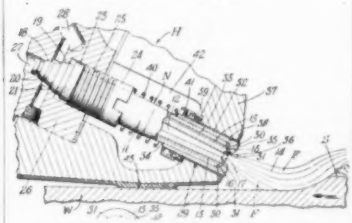


Recently patented vertical welding machine consists of a pair of relatively movable transformer coils and nut and screw means to effect the relative movement. A manually rotatable cap is fixed to the screw and a knob rotates the cap. The indicating dial has a series of spaced indices and a fixed indicator line positioned relative to the indices. An eccentrically shaped pulley is fixed to rotate with the dial. A cable is attached to and operates over the eccentric portion of the pulley and has its other end connected to one of the coils. A spring rotates the dial and pulley to maintain the cable under tension. This makes the relative movement of the coils effect a non-uniform rotation of the dial and cap.

* * *

Flame-Scarfing Process

2,493,802. JAMES H. BUCKNAM, Cranford, and IVAN P. THOMPSON, Elizabeth, N. J. Assigned to The Linde Air Products Co., New York City. Filed May 10, 1949. Granted Jan. 10, 1950.



Newly patented flame scarfing process was developed to treat ferrous metal at a hot-rolling temperature. It comprises discharging a flat stream of commercially pure oxygen at a velocity of 1,000-1,600 ft per second at an acute angle against the metal. Simultaneously, thinner upper and lower streams of commercially pure acetylene are fed at acute angles into the stream of oxygen at a velocity of 240-267 ft per second. The resulting mixture of oxygen and acetylene produces a flat stream of scarfing oxygen sandwiched between post-mixed oxyacetylene preheating flames having primary combustion zones about 1¼ in. long.

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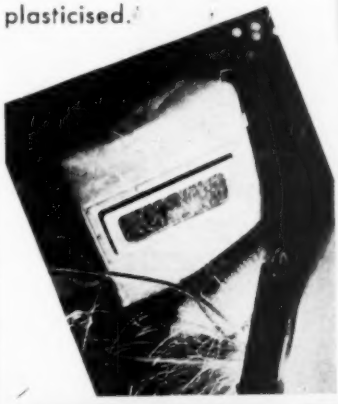

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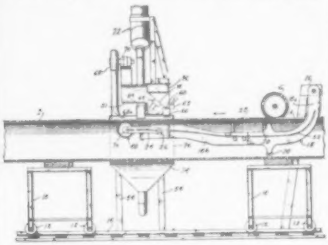
436 Canal Street ● Rome, New York

Magnetic Testing of Weld

2,495,544. Robert A. Petersen, Dolph F. Heckle and John E. Clarke, Chicago. Assigned to Magnaflux Corp., Chicago. Filed Sept. 6, 1946. Granted Jan. 24, 1950.



Newly patented magnetic testing apparatus was designed especially for checking longitudinal seam welds on piping. It consists of a fixed position welding head and means for moving a pipe with a longitudinal joint past the head. A support arm is adapted to fit inside the pipe and also to project through the longitudinal joints ahead of the welding head. On the inside portion of the support arm is a roller member that rolls on the internal surface of the joint behind the welding head. A magnetizing coil is wound around the roller member. When current is supplied to the magnetizing coil, a magnetic field is established in the longitudinal joint.

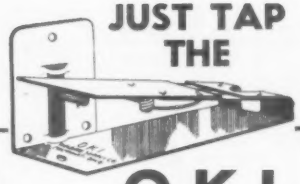
* * *

Arc Spot Welding

2,498,241. Hugh S. Bowen, Fairfield, Ala. Assigned 49% to Walter B. Bowen, El Paso, Tex. Filed Jan. 28, 1949. Granted Feb. 21, 1950.

An arc spot welding apparatus has a combination of an elongated sleeve of insulating material, an electrode holder held in the sleeve and an elongated guide slidable on one end of the sleeve to provide an electrode holding chamber. The guide has an outer wall with an opening connected to the chamber. A pair of elongated pockets are provided at opposite sides of the guide outside of the chamber. A pair of fingers are attached to the sleeve and to end pieces slidable in the pockets. An electrode extends through the opening into the chamber and has its inner end held. Compression springs in the pockets bear against the ends of the fingers for retracting the electrode into the chamber.

JUST TAP THE



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SAN FRANCISCO: 68 Post St. (4)

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1 ea.	**General Electric** Sequence Timer, NEMA Type 2B, G.E. No. CR-7503F-117-G4 (NEW)	50.00
1 ea.	**General Electric** Sequence Timer, NEMA Type 9B, G.E. No. CR-7503F-127-G2 (NEW)	50.00
4 ea.	**Square D** Welding Timer, Class 8991, Type TBS1, 440 volt, 60 cycle (NEW)	30.00
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All Electrodes packed for export. Write for prices.
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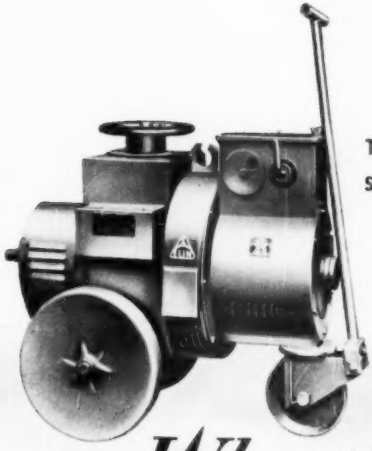

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60-375 amp — 1750 rpm

FULL NEMA RATING

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